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RURAL ELECTRIFICATION
IN
PENNSYLVANIA

January · 1928

Prepared by
The Pennsylvania Joint Committee on
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ELECTRIFICATION
IN
PENNSYLVANIA

Prepared by

The Pennsylvania Joint Committee *on*
Rural Electrification

Headquarters - 707 *Telegraph Bldg.: Harrisburg, Pa.*

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INTRODUCTION

Just as our cities today feel that they could not get along without the comforts, conveniences, and motive power supplied by electricity, so our agricultural people are beginning to feel an equal need for this same service. Only a small percentage of our farms today have electricity but the proportion desiring it is many times greater. The agricultural industry is of no small importance to the welfare of this state for it comprises one-tenth of the population, one-fourth of the total capital invested in the state and has a gross income of well over a million dollars for each day of the year.

A peace-time revolution has been taking place on the farms within the last 25 years. Gratifying progress has been made in improving the highways. Mail is delivered daily, telephones and automobiles are in general use, isolation has been banished, and the farm has become a part of a larger community. There still remains in the greater number of farm homes however, the need of overcoming the drudgery of the household, as well as the rendering of quick and convenient power to the manifold tasks that must be done about the farmstead. It is to these tasks that electricity will bring a lasting relief.

It is to the accomplishment of this end that the Pennsylvania Joint Committee on Rural Electrification is directing its efforts. The Public Service Commission of Pennsylvania has issued General Order 28 and uniform rules and rate schedules for the extension of service have been filed by the electric light and power companies. This bulletin is issued for the purpose of acquainting those desiring electric service with its advantages and applications, with the provisions of the General Order and the assistance that is being rendered through this Committee. For almost a year, the Committee has been at work formulating policies and procedures that would make the practical application of General Order 28 most effective.

The Order offers the fullest opportunity for cooperation and fair dealing on the part of rural groups and the electric companies serving them. Wherever such a spirit prevails, it will be possible to extend service under conditions that will be mutually satisfactory.

PART I

ELECTRIFICATION OF THE FARM PAYS

Electricity has proven to be the most convenient and dependable as well as the cheapest servant in the home. It has served with equal satisfaction and economy in the factory as an aid in making man's labor many times more productive. On the farm which is both a home and producer of food products electricity will give even greater satisfaction as a convenience and as an aid to labor will produce higher quality products more economically.

Nearly everybody wants electric service for its convenience, but only those who have had it appreciate its money value. Charges for electricity are designed so that the unit cost of current is greatly reduced with larger use of current. Wherever a motor can be installed to replace hand work there is a great saving in cost and relief from drudgery. One horse-power of work for a period of one hour will cost from two to eight cents depending on the rate charged. A horse-power is equivalent to seven man-power. Can a farmer get seven men to do the work of a horse for six cents per hour?

When the true earning capacity of electricity is recognized in the saving of time, fuel, labor and as an aid in the production of quality products, then rural electrification will become an accomplished fact.

Rural electrification in Pennsylvania is, as yet, relatively a new development. None of us know the full extent of service it will render. Some of the results obtained from experience and thru research work are given here, as an aid to those who wish to know what electricity will do, what it will cost and what it is worth.

The following is a partial list of the jobs that electricity is doing on farms, better and more cheaply than is possible by other means. Only the general uses are mentioned here, although over 200 applications are in operation thruout the country. Your electric company can tell you whether special uses you may have in mind can be made profitable.

General Farm Uses

- Illumination—Yard Lighting
- Pumping Water
- Feed Grinding
- Ensilage Cutting
- Hay Hoisting
- Fruit Grading

In the Dairy

- Milking Machines
- Clippers
- Separators
- Churns
- Refrigeration
- Sterilizers
- Ventilation by fans

Poultry House

- Lighting to increase egg production
- Incubator
- Brooder
- Heater
- Sorting Eggs

Farm House

- Illumination
- Range
- Water System
- Washing Machine
- Irons and Ironer
- Vacuum Cleaner
- Table Appliances
- Refrigerator
- Radio
- Sewing Machine

This list gives a good idea of the more common applications that are being made on the farms today.

The Electric Line brings to the farm mankind's most useful servant—Electricity.

VALUE OF ELECTRICITY FOR LIGHTING

Lighting is the first use to which electricity is commonly put when it becomes available. It is thought of chiefly as a convenience and not measured at its true worth based upon better illumination, labor saving and safety.

Many people appear to think that electricity is only worth $1.00 to $2.00 per month. Before accepting this as a fact, consider the labor of cleaning and filling the lamps and lanterns, some of them every day, others possibly once a week, the cost of the fuel burned and the chimneys that have to be replaced and the wicks burned out. Is it not time to consider that labor on the farm, even if done by the family, has a real money value?

Equally important is the increased efficiency with which the work about the house and the farm can be done with good lighting. Picture one man groping his way through the shadows cast by a lantern which requires the use of one hand, leaving the other free for work and ask how he can hope to win in the race of economical production of quality products with the man who has the advantage of good light with both hands free for work. For about six months of the year a large share of the morning and evening work is done by artificial light, particularly on dairy farms. Would it be fair to assume that one hour a day might be saved in the time required to do the morning and evening work with adequate illumination? Many farmers say this is true. Such a labor saving would mean thirty hours per month which at 25c per hour would amount to $7.50 worth of labor saved.

It is a marvel that lamps and lanterns have not caused many more fires. Only the unceasing care and diligence of the farm family in observing every precaution have prevented many fire losses. This fire hazard is greatly minimized by electricity, the additional safety thus provided proving a great satisfaction to many who recognize that a fire in the country usually means the destruction of their property.

Electric lighting is much more valuable where the wiring system is carefully planned so that there are ample outlets at the points where lights will be needed for the many tasks to be done. Due largely to the wonderful increase in efficiency of light bulbs, the actual cost of current is relatively small. In the case of five different farms, the average monthly kilowatt-hours used for lights and some small appliances, ranged from 18 to 36. The month to month use varies somewhat from these averages. For instance, the December current used on individual farms in one State varied from 10 to 61 kilowatt hours. The amount of current used for lighting depends on the requirements and habits of the individual farm home.

ELECTRICITY ON THE DAIRY FARM

Electricity finds many uses in the dairy, because it is particularly fitted to drive equipment used in milk handling. In the shredding, grinding and mixing of feed, the handling and cooling of milk, churning, separating, furnishing running water, and even in the care of the cattle, it plays an important part.

The production of milk to meet the present exacting standards necessary for city use requires extreme care. Here electricity goes to work. It clips the cows, does the milking, sterilizes the dairy utensils, and cools the milk more cheaply and more efficiently than can other agents.

A stable must be kept clean, light and well-ventilated if the cattle are to give the highest production. Ventilation of dairy barns, particularly for the Pennsylvania bank barn, is attracting more and

Poultry House

- Lighting to increase egg production
- Incubator
- Brooder
- Heater
- Sorting Eggs

Farm House

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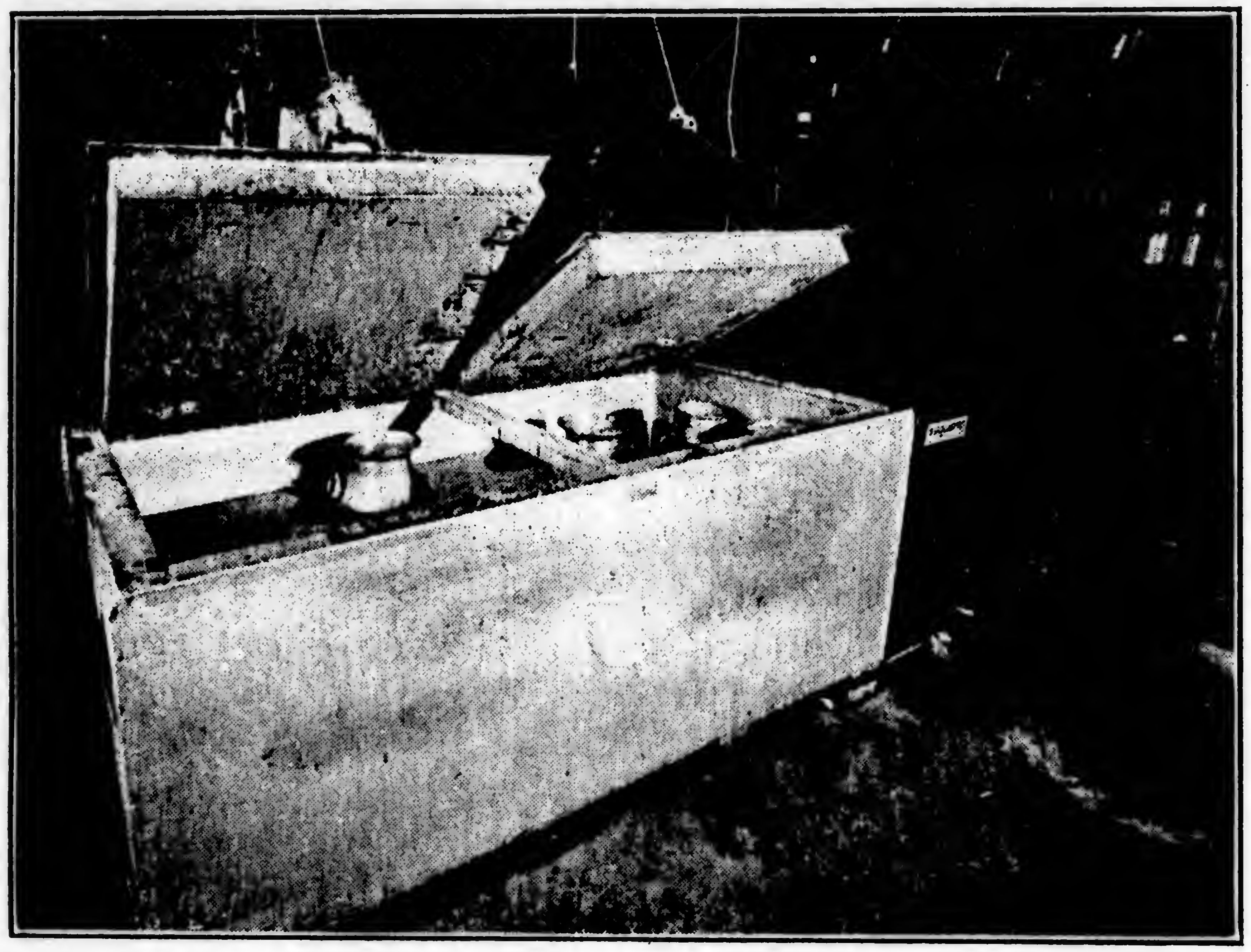
INTENTIONAL 2ND EXPOSURE

more attention as it is realized that fresh air is just as important to the health of a cow as good drinking water. Electric lights materially reduce the time required for the early morning and evening milking, feeding and other chores and result in a cleaner better product.

Milk Cooling: Many farmers are using electric refrigerating equipment to cool their milk, the first cost of which is less than that of an ice house and its equipment. The operating expenses of this equipment amount to no more than the expense of cutting ice and filling the ice house each year. Some instances are noted where farmers using electric milk-cooling outfits state that if ice were delivered free of charge at the milk house door, they would not take the trouble to wash it and place it in the cooling tanks for the trifling cost of electricity to operate the refrigerator.



Cooling Milk Brings Higher Price

CURRENT CONSUMPTION OF DAIRY REFRIGERATORS

I—Milk Cooling and Storing Refrigerators

Installation	Average Kilowatt hours per month	Kilowatt hours per month per 100 qts. milk	Storage Capacity	Insulation of Storage Tank
Case 1	50	62.5	4′ x 4′ x 8′	3 Layers of Celotex and 2″ air space.
Case 2	—	75.0	3′ x 6′ x 30″	4″ ground cork
*Case 3	500	60.0	6′ x 6′ x 7′	4″ cork board
Case 4	300**	110.0**	160 qts. Max.	6″ concrete and 2″ or 3″ corkboard.

II—Milk Storage Refrigerators

Farm No.	Quarts Stored	Kilowatt hours per 30 day period		Extent of Record
		Maximum	Average for 8 months	
1	300	226	96.5	April to December 1926
2	300	164	112	August 1925 to Dec. 1926
3	300	175	148	April to December 1926

Above data taken from 4th Annual Report of the Committee on Relation of Electricity to Agriculture.

Drinking Cups for Cows: A limited test conducted in Minnesota indicates a marked increase in milk production when indoor drinking cups are used. On the basis of this test a 15 per cent. yearly increase in milk production is indicated. Studies on this same subject by the U. S. Department of Agriculture conducted in eastern Maryland show a 5 per cent. increase in milk production. This variation is probably due in a large measure to the differences in climatic conditions. It is still a question as to whether these increases were not due to the warm water. Many authorities on the subject consider warm water as the primary cause; if this is true, an indoor tank filled by a small electric pump will be very productive.

Milking Machines: In a recent survey conducted by one of the agricultural magazines in which over a thousand farmers were asked their experience with milking machines, all but a very few said that more attention as it is realized that fresh air is just as important to the health of a cow as good drinking water. Electric lights materially reduce the time required for the early morning and evening milking, feeding and other chores and result in a cleaner better product.

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*This was a 2-ton ammonia plant which also furnished ice for the cases of bottled milk when they were loaded for delivery. The storage room was kept at 40° F. Temperature.

**Estimated.

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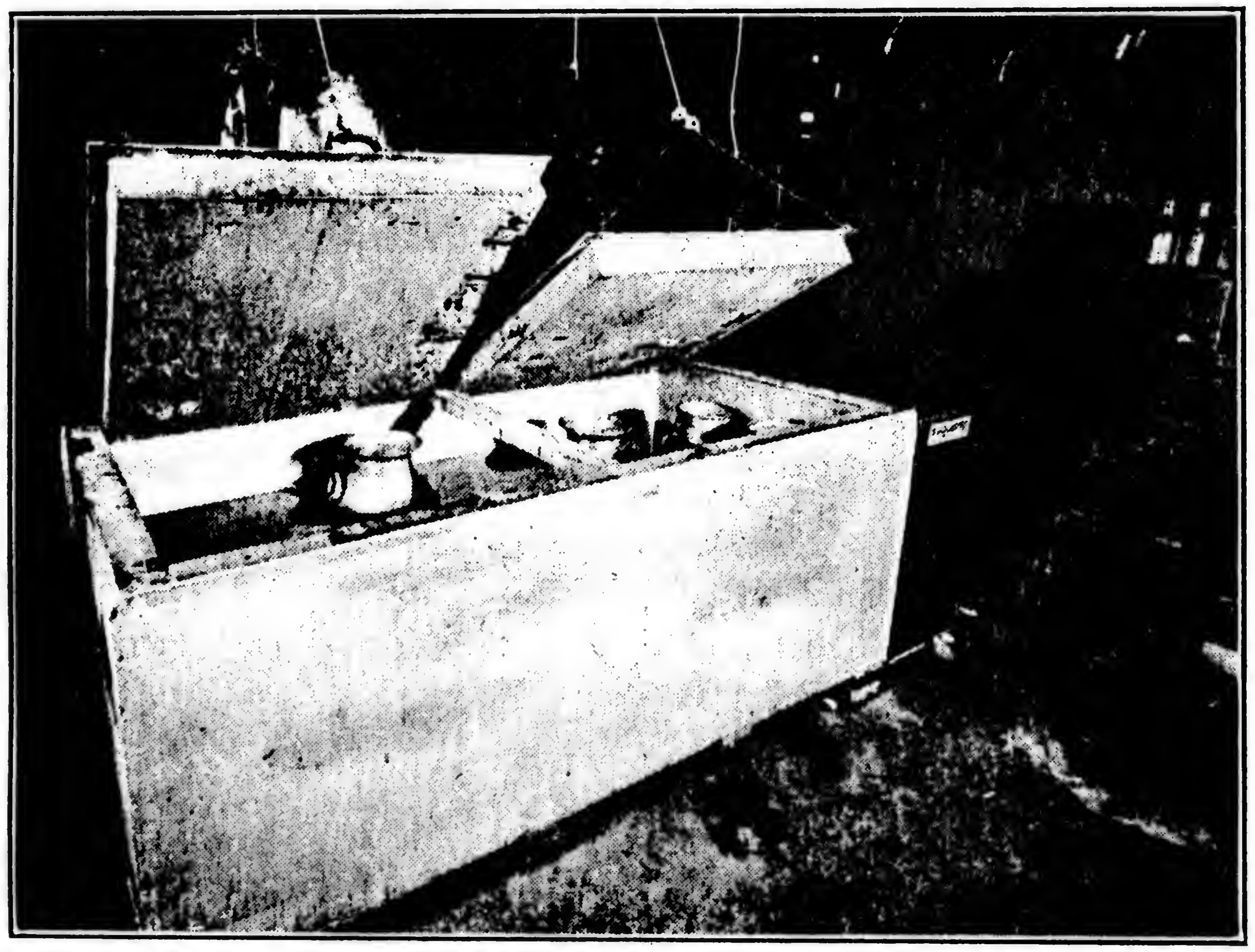

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the machines agreed with their cows, and enabled them to get as large a production as when milked by hand. A big saving in time was reported, some stating that the machines save the expense of one man, and others that on the basis of time to get the work done with the same help, the machines enabled them to finish in much less time. For the most part, these 1,000 farmers had used milking machines for more than two years. The herds varied in size, as did the number of hands employed but the usual report was about 25 cows and one or two men.

Current Consumption of Milking Machines: The average current used by portable machines in a number of cases in two states was 12.8 K. W. H. per month per ten cows milked. At ten cents per K. W. H. this amounts to 12.8c per cow per month; at five cents per K. W. H. the cost is 6.4c per cow per month. A test on pipe line machines conducted in eleven states showed a use of 31.1 K. W. H. per month per ten cows milked.

Other electrical dairy appliances which can be driven electrically are separators, churns, ventilator fans, clippers, milk coolers, water pumps, sterilizers, bottle washers, ensilage cutters and feed grinders.

INCREASING EGG PRODUCTION

Egg production usually declines in winter. Hens go to roost at twilight and consequently in winter they have less exercise, consume less food and lay fewer eggs. Artificial lighting of the poultry house in winter lengthens the hen's day; she therefore scratches about more, consumes more food, and lays more eggs during this season.

ELECTRIC LIGHTING FOR EGG PRODUCTION
Data Taken October 1, 1925 to April 1, 1926

	Number of birds	Number of Eggs	Value of Eggs	Kilowatt hours of Electricity used in 6 months	Cost of Feed & Electricity	Cost of Feed	Additional Returns
1. Best Pullets with lights	112	11807	$345.37	55	$135.24		$35.17
Best Pullets without lights	115	10617	298.79			123.83	
2. Less mature Pullets with lights	114	10979	315.86	51	132.40		49.89
Less Mature Pullets without lights	115	9064	255.33			121.76	
3. Yearling Hens with lights	197	5213	152.51	108	191.72		32.32
Yearling Hens without lights	199	4798	117.24			188.77	

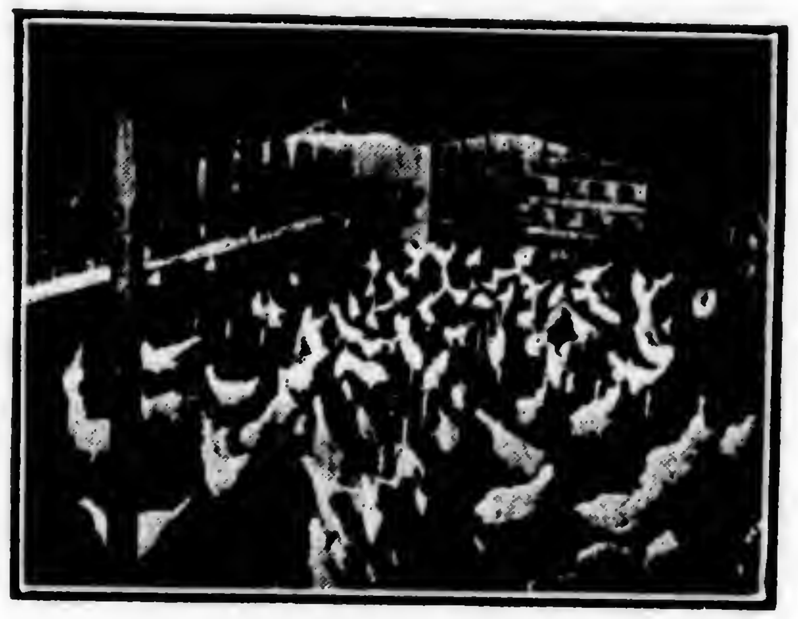
A great many careful tests conducted both with selected flocks and under more ordinary conditions, have shown that the additional value of the eggs obtained in winter when prices are high has been enough greater than the cost of the lighting and the additional food consumed to return a good profit.

Data collected by the National Committee on the Relation of Electricity to Agriculture shows there are good returns realized by artificially lighting the poultry house.

For egg production the general illumination of the entire poultry house is as important as the illumination on the floor. If the perches are dark the birds will not come down to feed, and if only a small area of the floor is lighted they will crowd together within the lighted space.

There is no objection to turning the lights on suddenly but if they are turned off suddenly and the flock is plunged into unexpected darkness, the birds fly about, knock one another off the perches, and many roost on the floor. Hence some arrangement should be provided to extinguish the lights gradually to simulate the effect of natural approach of twilight. A satisfactory method of dimming is secured by providing a main circuit for the general lighting, which can be turned off at the desired time, and leaving on a 10 or 15 watt lamp on a separate circuit for an additional 10 or 15 minutes. A number of agricultural colleges have prepared special bulletins covering this subject.

Perches Not Lighted—Bad


Good Illumination

A simple device to keep the drinking water in the hen house from freezing overnight may be constructed by soldering a tin can over a hole in the bottom of the water container and placing a 15-watt lamp inside the can. The lamp is left burning all night in severe weather.

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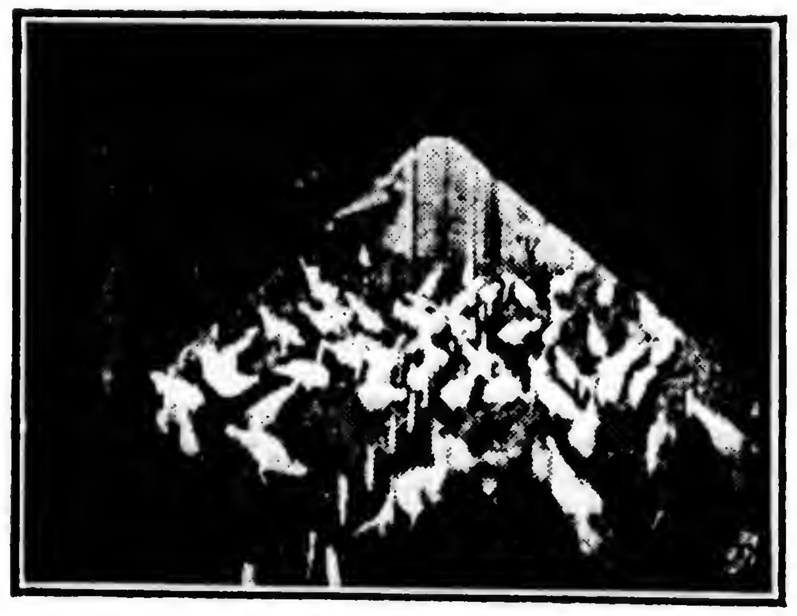
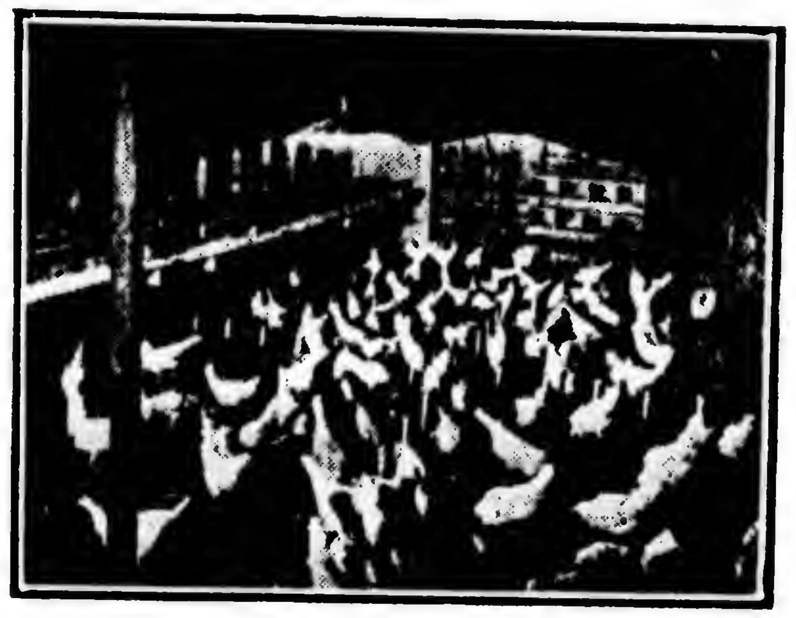


Perches Not Lighted—Bad



Good Illumination

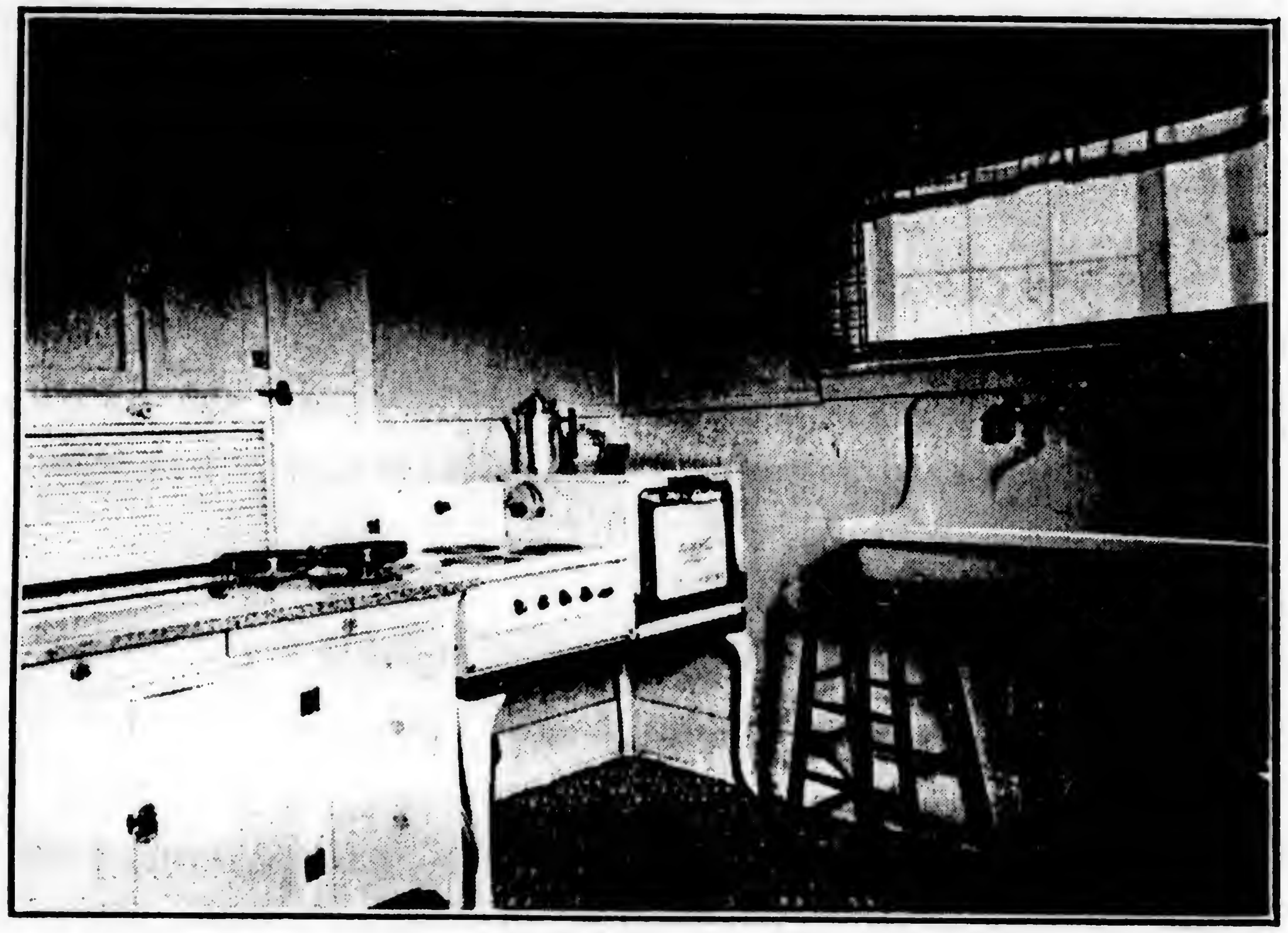
A simple device to keep the drinking water in the hen house from freezing overnight may be constructed by soldering a tin can over a hole in the bottom of the water container and placing a 15-watt lamp inside the can. The lamp is left burning all night in severe weather.

INTENTIONAL 2ND EXPOSURE

ELECTRIC COOKING

The electric range is taking its logical place in the list of modern farm conveniences with the electric light, the vacuum cleaner, the washing machine and others.

The reasons underlying the success of electric cooking are many. To begin with, it is by far the most convenient method of preparing food. A turn of the switch starts the heat. There is no fire to build, nothing to be lighted with a match, no fuel to carry. The operation is as simple as turning on an electric light. The possibilities for automatic control add much to its convenience. The meal can be placed in the oven and without further attention, its cooking will be started and stopped by the automatic control, with greater freedom from the kitchen as a result. The cleanliness of electric heat commends it strongly to the housewife. It produces no smoke or soot and consequently does not deposit dirt on kitchen walls.



—Courtesy Lloyd Fruit Farm, Luzerne County

Electric Range in Kitchen

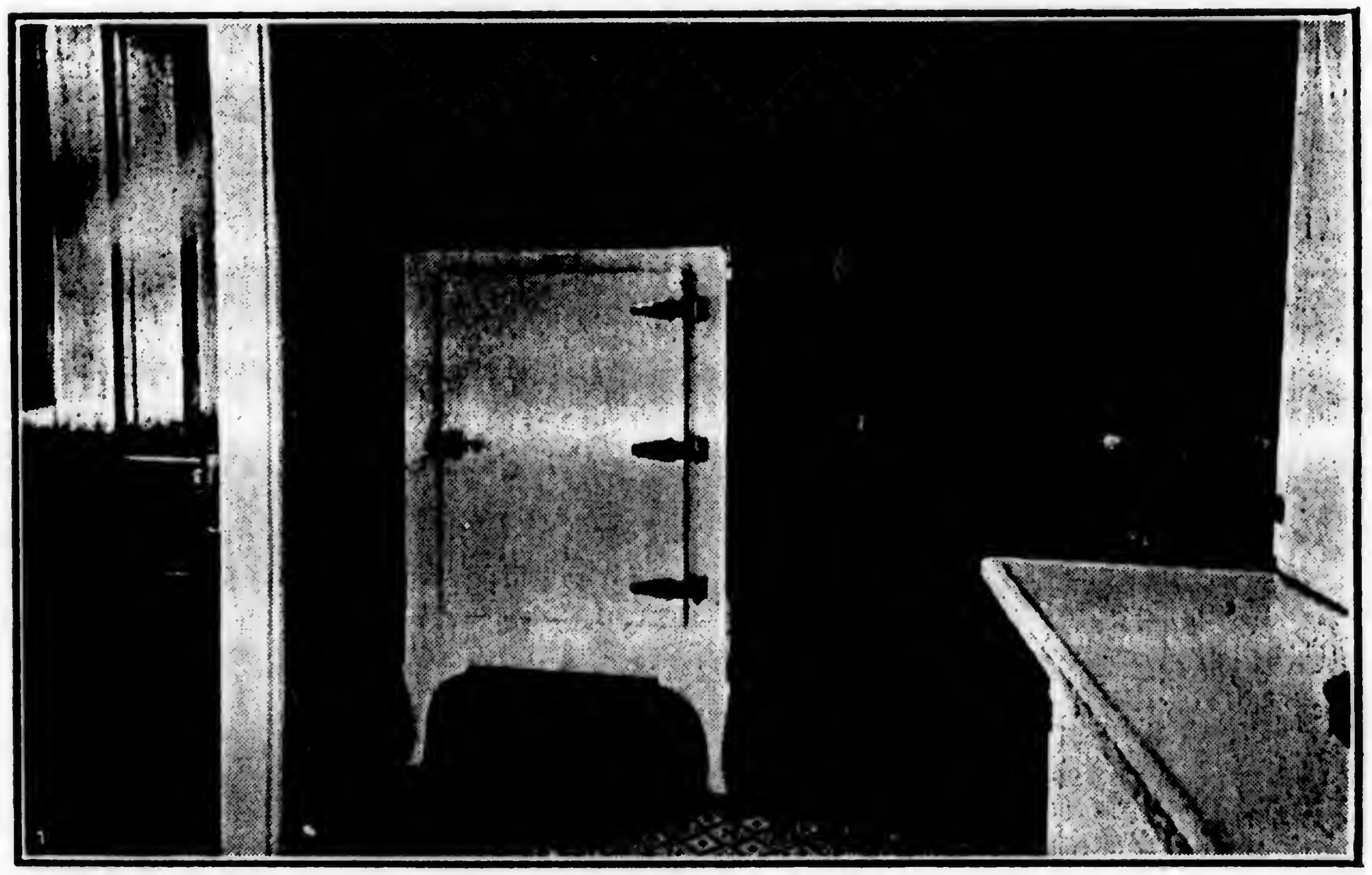
Because the heat storage principle is used with this kind of cooking, shrinkage of foods is greatly reduced. In addition, a kitchen free from gases and fumes, created by fuel stoves is a healthier, safer kitchen for everyone. There is no open flame, no oxygen is taken from the air, and no gases can be given off. The average family will use from 80 to 150 K.W.H. per month for cooking. A safe figure to use in estimating consumption is 0.8 to 1.2 K.W.H. per day per person.

COST OF ELECTRIC COOKING

The following results show the typical average monthly bills at various electric rates for a full automatic electric range:

Farm	Average monthly cost in dollars and cents at various rates per kilowatt-hour		Average number of people in the family over a period of 6 months
	3 c. / KWH	4 c. / KWH	
No. 1	$3.75	$5.00	4
2	5.55	9.25	6
3	4.89	6.52	4
4	5.61	7.48	Varied
5	6.84	9.12	6
6	7.05	9.40	10

A combination coal and electric range is available to meet the demands for kitchens where no provision other than a stove has been made for heating. In it are combined all the advantages of automatic electric cookery with a small coal stove for heating and for keeping a supply of hot water available.



Electric Refrigerator in Kitchen Saves Many Steps

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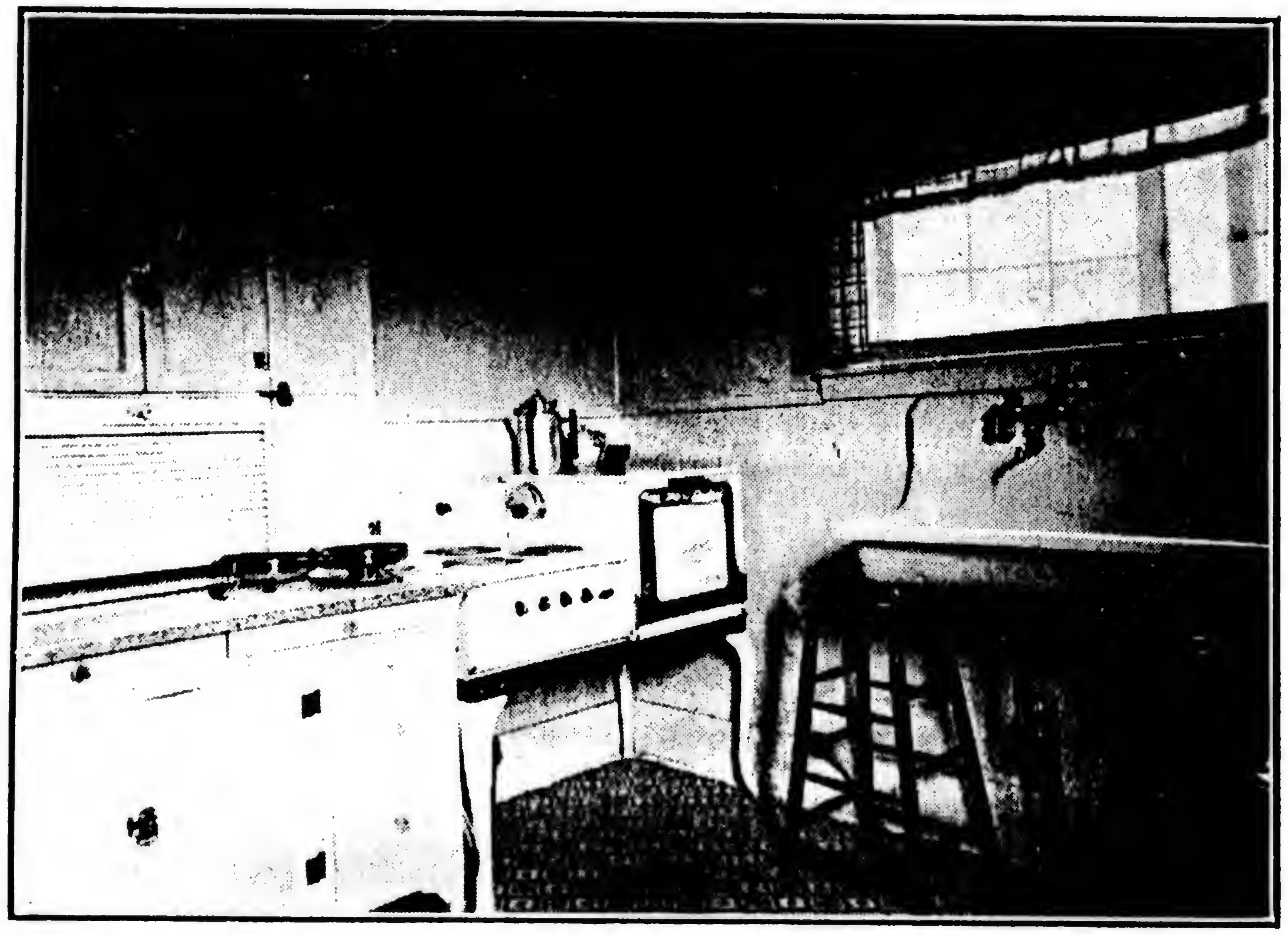

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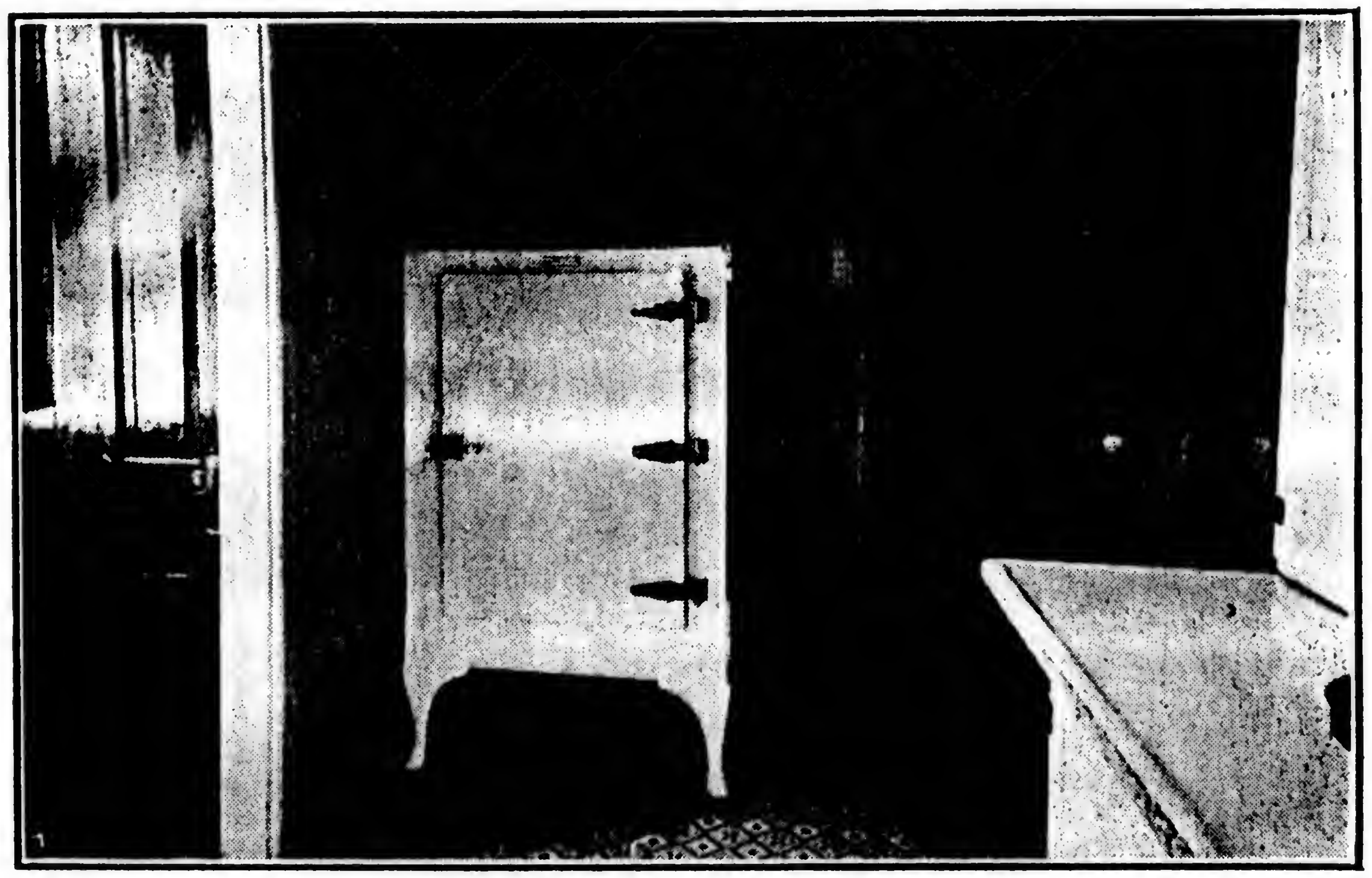


Electric Refrigerator in Kitchen Saves Many Steps

INTENTIONAL 2ND EXPOSURE

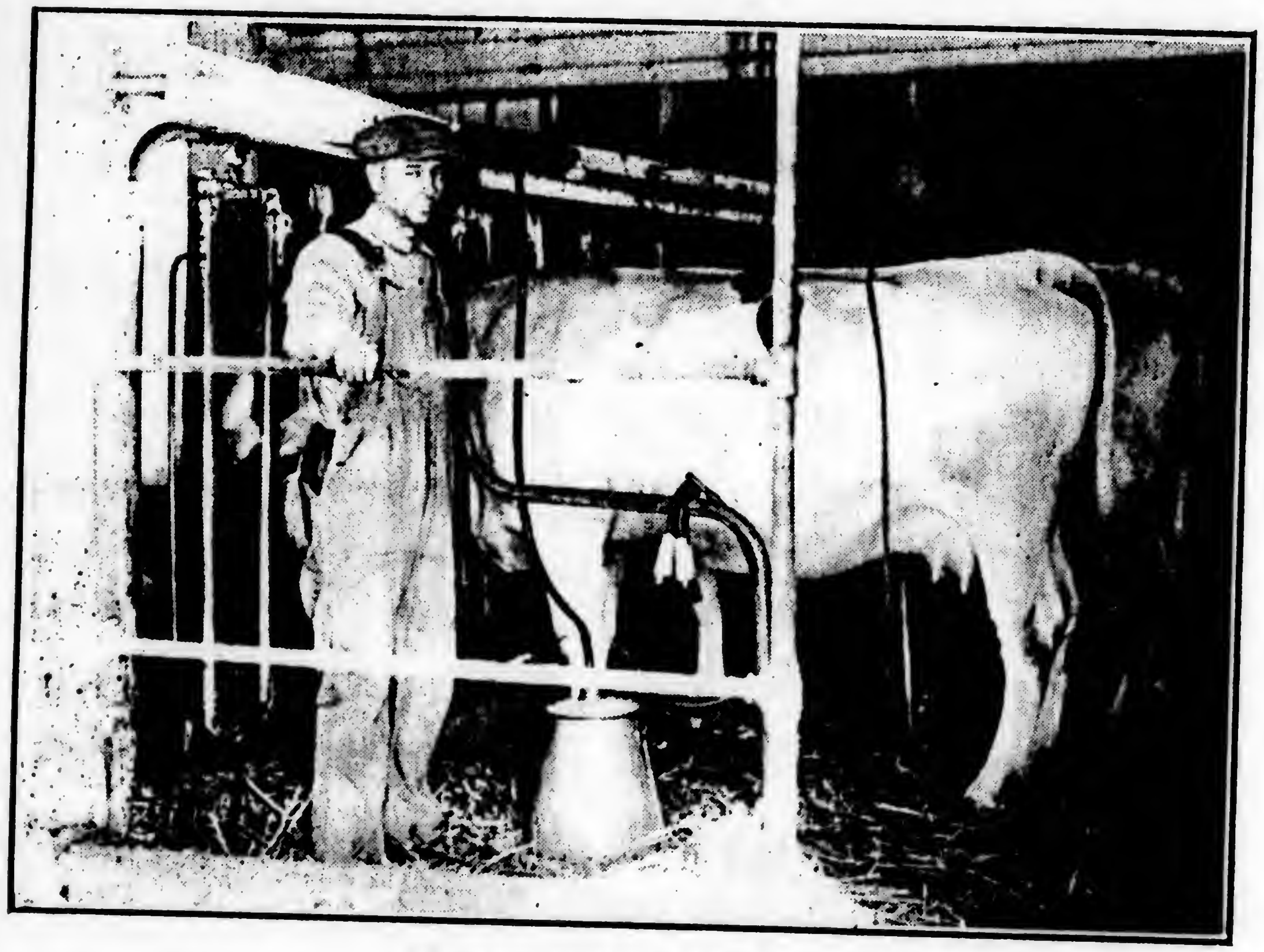
ELECTRICITY ON FARMS IN PENNSYLVANIA

FLOYD MERKEL FARM

The Farm: Lying at the foothills of the Blue Mountains, a half a mile east of Hamburg, Pennsylvania, is a 90 acre farm owned by Floyd Merkel.

This farm is operated with two horses and a farm tractor. The tractor operates a grain threshing machine and an ensilage cutter and blower. This equipment is used but a few days in the year. The balance of the power is furnished by electricity.

Mr. Merkel operates a general farm, with an average of 400 to 500 white leghorn chickens, 13 cows and 7 heifers. The products are retailed in Hamburg and vicinity. The work is done entirely by the farmer and his family.



Electric Milking Machine.

All of the out-buildings are wired for electric service as follows:

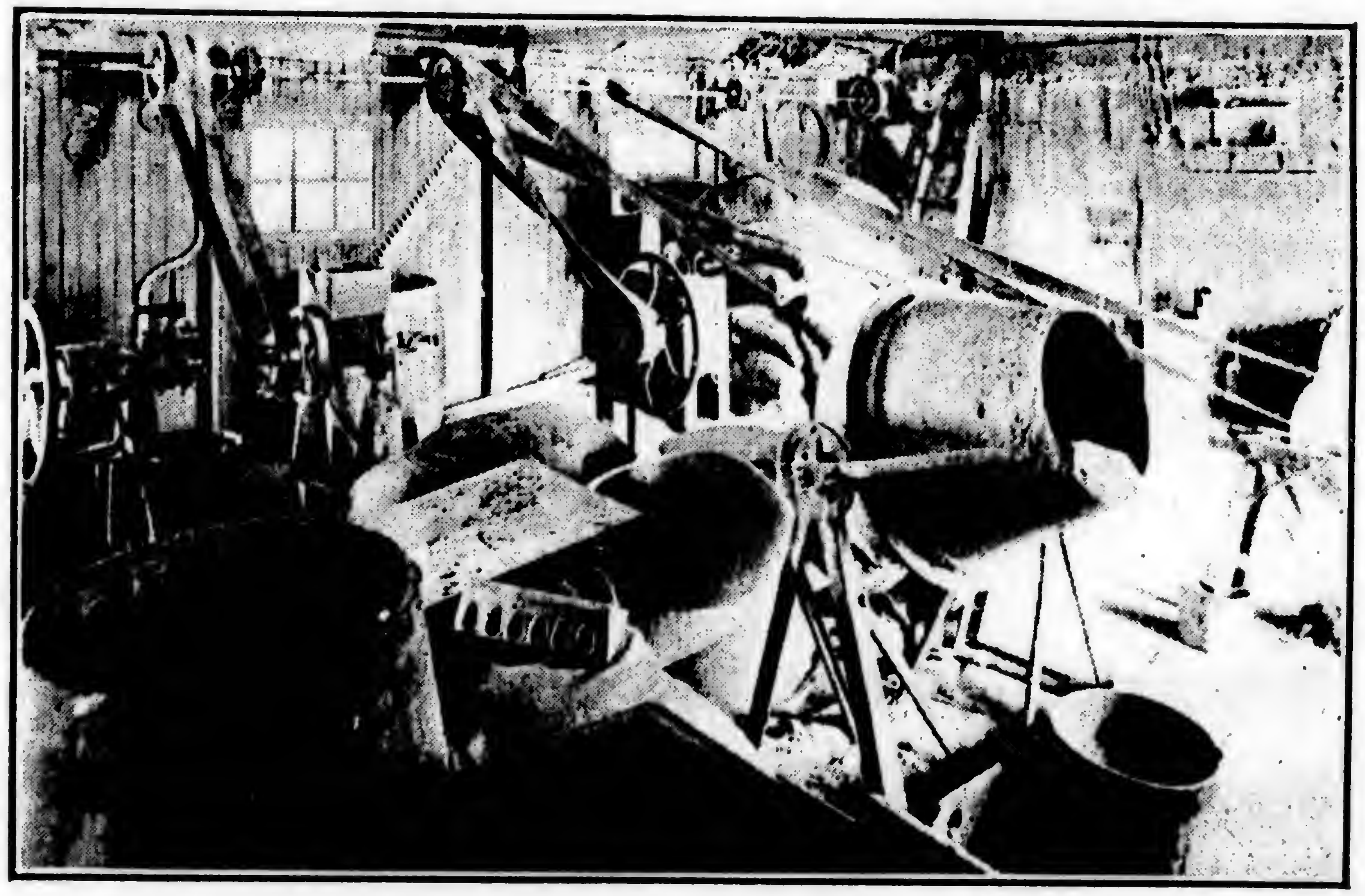
Farm repair shop	2 lights	Barn lighting	7 lights
Milk house	2 "	Chicken house	9 "
Farm yard lighting ...	1 "	Pump house	1 "

A time switch is used in the poultry house to turn on the lights early in the morning, with the result that the egg production is increased by an appreciable amount. Mr. Merkel considers this a good investment.

The House: Mr. Merkel's home, as equipped, should be a delight to any farmer's wife, and yet it is economical enough to be within the means of the average farmer. It contains nine rooms, completely wired for light. An electric range is installed in the kitchen while the other appliances used in the home are an iron, washing machine and vacuum cleaner.

Water Supply: Water for the house is pumped from a fresh water spring by means of a shallow well automatic pump, operated by a 1/4 H. P. motor. The water supply for the barn and milk house is supplied from a spring located at some distance from the farm buildings.

The Milking Machine: The milking machine is a four cow outfit which has been in service between 12 and 14 years, and is giving complete satisfaction.



Electric Power in the Feed Room

The Feed House: The feed house is located next to and against the barn, between the cow stable and the chicken houses.

A one horse-power motor located in the feed house is belted to a line shaft, and operates the following equipment:

1. A power or hand type bone-cutter which requires the full one horse-power.
2. A small power or hand type feed-grinder requiring about 1/2

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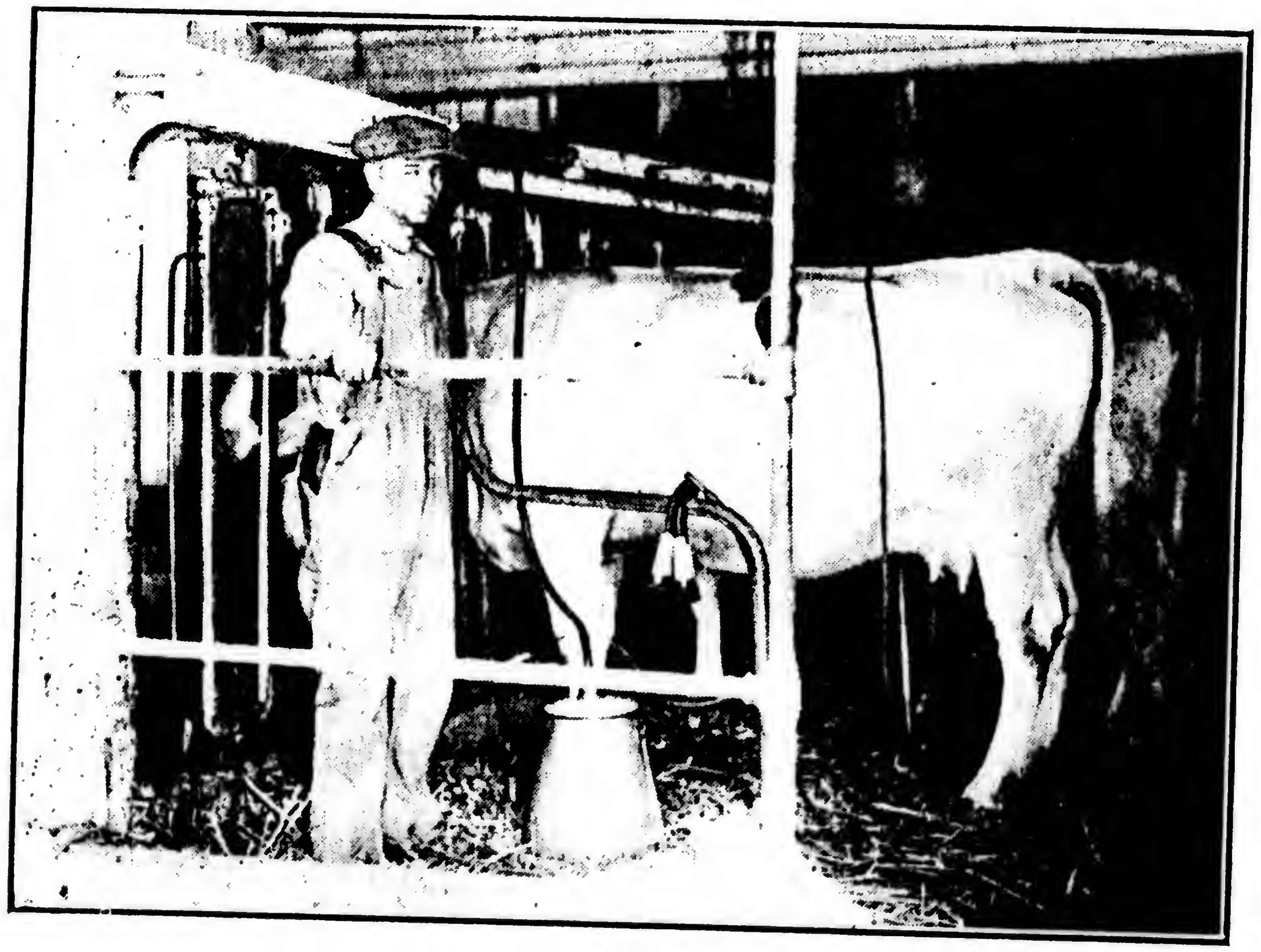

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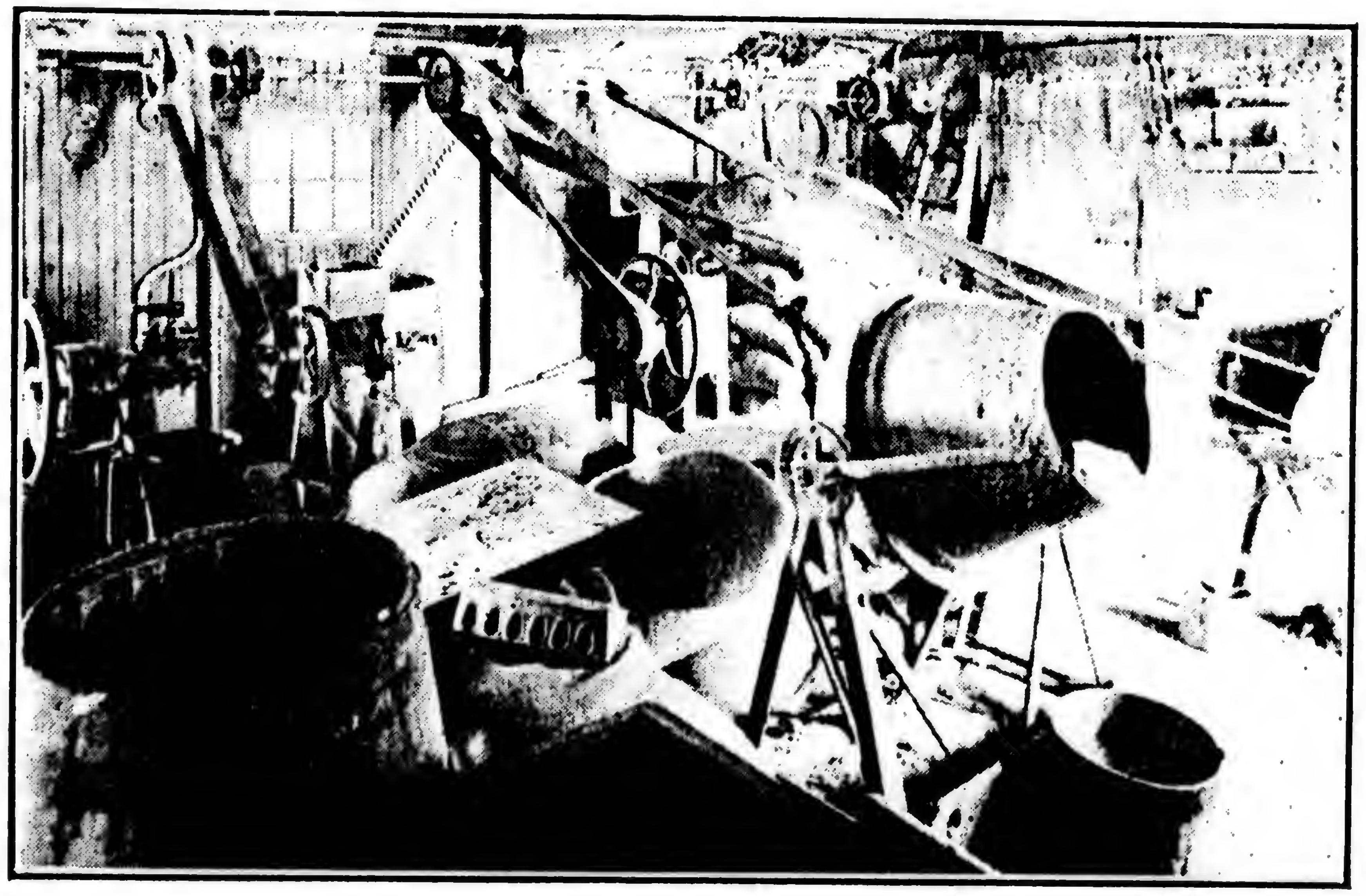

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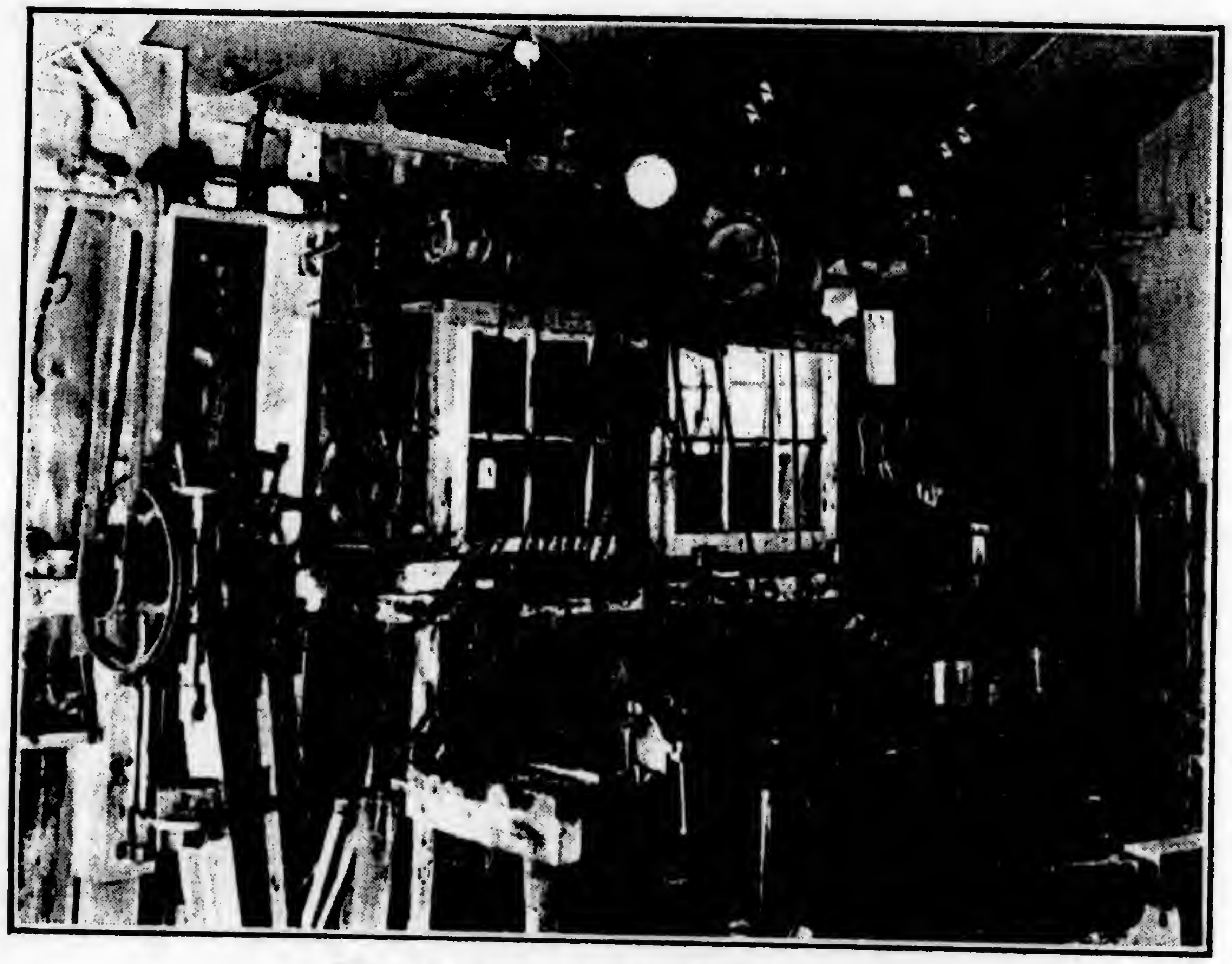
INTENTIONAL 2ND EXPOSURE

to ¾ H. P. is usually operated at the same time the milking machine is in use. It prepares feed in all of its forms and grinds corn meal at the rate of two bushels per hour per horse-power.

3. The corn sheller of the ordinary semi-power type.
4. The grind-stone of the usual hand type with a pulley attached for power application.
5. A 2½ cu. ft. power or hand type concrete mixer. This finds a novel application in mixing various feed combinations for the stock when not in use for mixing concrete.

The Repair Shop: A small ¼ H. P. motor is located in the repair shop, belted to a short shaft. It provides power for operating a ratchet drill press and a 5-inch emery wheel.



Electric Power in the Repair Shop.

Mr. Merkel's Investment in Equipment

1. Wiring complete, with fixtures, including the wiring for the 1 H. P. motor		$295.00
2. Home Equipment:		
a. Range	$190.00	
b. Washing machine	100.00	
c. Vacuum cleaner	40.00	
d. Electric iron	5.00	
		$335.00
3. Repair Shop:		
a. Shafting, belting, etc.	$26.00	
b. ¼ H. P. motor	15.00	
c. Tool and sickle grinder	13.00	
d. Drill press	18.00	
		$72.00
4. Feed Preparation Equipment:		
a. 1 H. P. motor	$70.00	
b. Shafting, pulleys, etc.	40.00	
c. Belting	33.00	
d. Green bone cutter	28.00	
e. Feed grinder	16.20	
f. Corn sheller	14.75	
g. Concrete mixer	26.00	
h. Grind stone	11.00	
		$238.95
5. Automatic shallow well water system, exclusive of piping		$108.00
6. Milking machine; (two-cow milker) complete		185.00
Total Investment		$1233.95

The current consumed ranged from 121 to 346 kilowatt hours per month and the monthly bill from $7.34 to $18.84.

MR. BARDO'S FARM

Mr. Bardo's farm of 60 acres is located midway between Bloomsburg and Millville, along an 11,000 volt line. He makes general farming, chicken raising and dairying his chief business.

In 1924, Mr. Bardo applied to his Electric company for service to supply light for the house and barn and power for a 2 H. P. motor. Shortly after electric service was installed he bought a 3 H. P. motor and mounted it on a wagon for portability. Other labor saving machinery was purchased as needed.

In order to operate the grain grinder, he replaced the 2 H. P. motor with a 5 H. P. motor.

His Equipment: At the present time he has a hay unloader, sheaf elevator, grain chopper, wood saw and fodder shredder, all operated with the portable 5 H. P. motor. A ½ H. P. motor is so located that to ¾ H. P. is usually operated at the same time the milking machine is in use. It prepares feed in all of its forms and grinds corn meal at the rate of two bushels per hour per horse-power.

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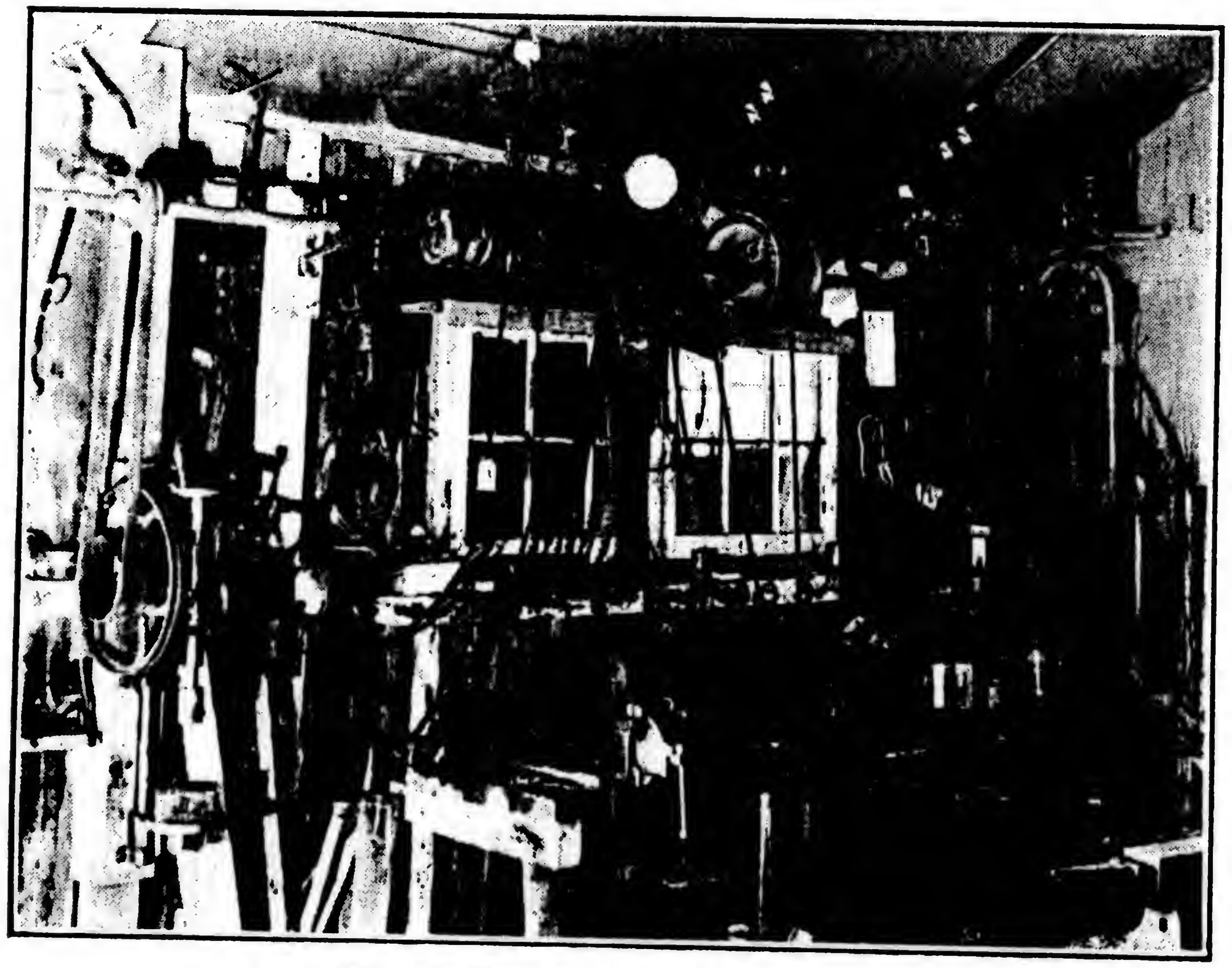

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INTENTIONAL 2ND EXPOSURE

the corn sheller, grindstone or seed grader can be operated independently. A ¼ H. P. motor on a water pump with a compression tank in the cellar of the house has also been installed.

Electricity Saves Man Labor: Mr. Bardo's investment was approximately $350.00 for the present labor saving machinery exclusive of wiring the buildings. He states as follows:

"Whenever the hay unloader, grindstone, corn sheller, or grain grader is in use, there is a saving of one man's time. With the use of the sheaf elevator two men can unload grain very easily and by using this machine there is a saving of from one to three men's time. The grain grinder is a very useful and time saving piece of machinery because I can operate it alone and do the chopping on rainy days or at such times that it is impossible to do other farm work. I figure the cost for electricity is nearly the same as the total charge at the mill would be, but in this particular case, it would take approximately two hours to make a trip to the mill to say nothing of the time and labor required to bag and load the grain or unload the chop. By having a fodder shredder, we can shred small quantities of fodder alone just as we need them, but if I were to hire a tractor to operate the shredder it would take two extra men, because it is likely that we would shred fodder for at least a day at a time and additional men would be required to get the fodder to and from the machine."

The motor operated wood saw produces a saving of about one-half as compared with a gasoline engine. Before Mr. Bardo had electric service, it cost him $6.00 per day for the use of a gasoline engine, but to operate the saw with the 5 H. P. motor (which is larger than required) cost $3.20 per day.

Probably the most appreciated and useful piece of equipment is the water system with compression tank, which enabled him to install a bath room in his house.

Mr. Bardo stated that through having electric service and labor saving electric machinery, he could save the cost of a man the year around, to say nothing of the convenience afforded his wife, by the use of electricity in their house. The monthly consumption of electric current ranges from 40 to 85 kilowatt hours and the monthly bill from $4.00 to $8.20 per month.

THE JOHNSON DAIRY FARM.

The Johnson Dairy Farm operated by Mr. G. W. Hack, includes 130 acres of land in Briar Creek Township near Berwick, Pennsylvania. It has been electrified to some extent for several years. The electrical power equipment which cost approximately $550.00, is as follows:

¼ H. P. Motor on Milk Bottle Washer.
1/6 H. P. Motor on Washing Machine.
½ H. P. Motor on Water Pump.
½ H. P. Motor on Milking Machine.
¼ H. P. Motor on Milk-Cooling Coil.
5 H. P. Motor on Line Shaft driving Corn Sheller, Grind Stone, Feed Chopper, etc.
Total 6 2/3 H. P.

The monthly consumption varied from 52 to 120 K. W. H.

It is Mr. Hack's belief that he is saving, due to his electrification an average of 5 man-hours per day, which based on wages of 35 cents per hour amounts to approximately $550.00 per year.

By means of the 5 H. P. motor connected to a line shaft Mr. Hack finds many profitable uses for electricity with little increased investment. It removes the drudgery from the farm labor and places it in the same class with the modern shop or factory.

Mr. Hack, as a dairyman, states: "With the milk cooler we are able to bottle milk about ten minutes after it is milked. With the use of the bottle washer the bottles can be washed in approximately one-third the time required by hand. With the use of the milker the milking can be done in about one-fifth the time required by hand. With the use of the grain chopper the feed can be chopped on rainy days or at times when we cannot do outside work conveniently."

COST OF OPERATING ELECTRICAL APPLIANCES

Rates for electric service vary throughout the State due to cost of labor, coal, freight and many other expenses making up the cost of operation and distribution in different localities, so that it is difficult to set a definite figure for cost of operation of any of the listed appliances. Most of the Electric Companies' rates are made up of block charges, the effect of which is substantially to reduce the charge for kilowatt hour with each block as the amount of current used increases. The lower blocks reach a point where electricity economically can be used for such purposes as farm power, cooking, and refrigeration, in addition to the more common uses.

The electric company will assist the prospective customer to estimate the monthly cost for a given amount of lighting, appliance and power use.

The following two tables show the approximate cost of operation of some of the most commonly used home and farm appliances at different rates for current.

TABLE I

The following table gives the number of minutes an appliance can be used at the cost of one cent. All the appliances listed in this table can be connected to a convenience outlet.

Appliance	Minutes of Operation for One Cent at Various Electric Rates per Kilowatt-hour				
	4 c.	6 c.	8 c.	10 c.	Remarks
	Minutes	Minutes	Minutes	Minutes	
Battery Charger 2 amp.	300	200	150	120	
Battery Charger 5 amp.	96	64	48	38	
Bayonet Heater 400 Watts	38	25	19	15	
Bayonet Heater 600 Watts	25	17	12	10	
Cozy Glow Heater 500 Watts	30	20	15	12	
Curling Iron 18 Watts	860	574	430	344	
Disc Stove 600 Watts	25	17	12	10	
Fans 8 inch	498	332	249	199	
Fans 10 inch	428	285	214	171	
Fans 12 inch	330	220	165	132	
Fans 16 inch	174	116	87	70	
Flat Iron Automatic 6 Lb. 660 Watts	25	17	12	10	
Lamps 25 Watt	600	400	300	240	
Lamps 40 Watt	378	252	189	151	
Lamps 50 Watt	300	200	150	120	
Lamps 75 Watt	198	132	99	79	
Lamps 100 Watt	150	100	75	60	
Motors 1/20 H. P.	192	128	96	78	Full Load
Motors 1/12 H. P.	120	80	60	48	Full Load
Motors ⅛ H. P.	81	54	40	32	Full Load
Motors 1/6 H. P.	70	47	35	28	Full Load
Motors ¼ H. P.	52	35	26	21	Full Load
Percolaters 400 Watts	38	25	19	15	
Sewing Machine Meter	498	332	249	199	
Table Stove 500 Watts	30	20	15	12	
Toaster 500 Watts	30	20	15	12	
Tumbler Water Heater 550 Watts	43	29	21	17	
Waffle Iron 600 Watts	25	17	12	10	
Warming Pad 65 Watts	228	152	114	91	
Electric Refrigerator (Household type)	75	50	37	30	
Portable Vacuum Cleaner	200	133	100	80	
Dish Washers	75	50	37	30	
Kitchen Aid Machine	200	133	100	80	
AC Operated Radio (6 tube)	200	133	100	80	

Note: For appliances not listed above, find out the size of motor used on the appliance and use the cost for that motor size as listed above.

TABLE II

The following table gives the cost in cents to operate each of the appliances one hour. These appliances should not be connected to the ordinary convenience outlet, but require separate wiring.

Appliance	Cost in Cents per Hour's Operation at Various Electric Rates per Kilowatt-hour.					
	3 c.	4 c.	6 c.	8 c.	10 c.	Remarks
	Cents	Cents	Cents	Cents	Cents	
Air Heater 1000 Watts	3.	4.	6.	8.	10.	Max. Heat
Air Heater 2000 Watts	6.	8.	12.	16.	20.	Max. Heat
Air Heater 3000 Watts	9.	12.	18.	24.	30.	Max. Heat
Bayonet Heater 1000 Watts	3.	4.	6.	8.	10.	Max. Heat
Bayonet Heater 2000 Watts	6.	8.	12.	16.	20.	Max. Heat
Bayonet Heater 2500 Watts	7.5	10.	15.	20.	25.	Max. Heat
Electric Hot Plates 8 inch	3.	4.	6.	8.	10.	
Electric Hot Plates 10 inch	6.	8.	12.	16.	20.	
Motors ½H. P.	1.5	2.	3.	4.	5.	Full Load
Motors ¾ H. P.	2.7	3.5	5.3	7.1	8.9	Full Load
Motors 1 H. P.	3.4	4.5	6.8	9.	11.3	Full Load
Motors 1½ H. P.	4.7	6.3	9.5	12.6	15.7	Full Load
Motors 2 H. P.	6.	8.	12.	16.	20.	Full Load
Motors 3 H. P.	8.9	11.8	17.6	23.4	29.4	Full Load
Motors 5 H. P.	14.7	19.6	29.4	39.3	49.	Full Load
Electric Range						
Large Oven top Unit 1500 Watts	4.5	6.	9.	12.	15.	Max. Heat
Bottom Unit 1500 Watts	4.5	6.	9.	12.	15.	Max. Heat
Small Oven 1000 Watts	3.	4.	6.	8.	10.	Max. Heat
10 inch Unit 2000 Watts	6.	8.	12.	16.	20.	Max. Heat
8 inch Unit 1000 Watts	3.	4.	6.	8.	10.	Max. Heat
Strap-en heaters						
1000 Watts	3.	4.	6.	8.	10.	Max. Heat
2000 Watts	6.	8.	12.	16.	20.	Max. Heat
3000 Watts	9.	12.	18.	24.	30.	Max. Heat
Ironing Machine (Electrically heated)	3.6	4.8	7.2	9.6	12.	

THE RIGHT SIZE OF A MOTOR TO USE

This table will help in determining the right size of motor to use with different farm machines. Because many machines vary in size according to need, the horse-power of the smallest, largest and most commonly used sizes are shown.

FARM MACHINES	Motor Horse Power		
	Smallest	Largest	Size most commonly used
Feed Grinders (Small)	1	10	3
Ensilage Cutters	5	25	5*
Shredder and Huskers	5	20	5*
Corn Shellers (single hole)	¼	1½	¼*
Fanning Mills			¼*
Grain Elevators	½	5	3
Concrete Mixers	2	10	5
Groomers (Vacuum System)	1	3	2
Groomers (Revolving)	1	2	1
Hay Hoists	3	15	5*
Root Cutters	¼	5	1
Cord Wood Saws	3	10	5
Wood Splitting	1	4	2
Oat Crushers	2	10	5
Cider Mills	2	5	2½*
Clover Cutters	¼	½	½
Water Pumps (Domestic Size)	¼	1	½
Cream Separaters	1/10	¼	⅛*
Butter Churns	⅛	3	¼*
Milking Machines (Portable Double Units)			1/6*
Milking Machines (Pipe Line type)	¾	3	3
Bottle Washers	⅛	¾	½*
Electric Refrigerator	1/6	1½	¼
Emery Wheels	⅛	1	¼*
Lathes	¼	½	½*
Forge Blowers	1/15	⅛	1/10*

*Indicates sizes commonly found in use by the National Committee on Relation of Electricity to Agriculture. Above data as well as that in Tables I and II taken in part from "Electricity the Pathway of Prosperity," Westinghouse Electric and Manfacturing Company.

STATE TEACHERS COLLEGE
SHIPPENSBURG, PA.

ENERGY CONSUMPTION FOR SOME USES OF ELECTRICITY ON THE FARM*

OPERATION	CAPACITY	LOAD Min.—Max.	K. W. H. CONSUMPTION	COST PER MONTH	
				At 4 c./KWH	At 8 c./KWH
House Lighting		100–2,000 watts	15 to 50 KWH per month		$1.20 to $4.00
Range		5,500–7,200 watts	100 to 150 KWH per month	$4.00 to $6.00	8.00 to 12.00
House Pump		¼ to ½ H. P.	10 to 20 KWH per month	.40 to .80	.80 to 1.60
Refrigeration		⅛ to 1/3 H. P.	30 to 70 KWH per month	1.20 to 2.80	2.40 to 5.60
Milking		¼ to 2 H. P.	0.75 to 2 KWH per cow per month	.03 to .08	.06 to .16
Cream Separator		¼ H. P.	1.1 KWH per 1,000 lbs. of milk	.044	.088
Grinding					
Ear-Corn	7 to 18 bu. per hour	2 to 5 H. P.	56 KWH per 100 bushels	2.24	4.48
Oats	6 to 15 bu. per hour	2 to 5 H. P.	56 KWH per 100 bushels	2.24	4.48
Shelled corn	10 to 25 bu. per hour	2 to 5 H. P.	14 KWH per 100 bushels	.56	1.12
Silo Filling	7.5 Tons per hour	5 H. P.	0.75 KWH per ton	.03	.06
Milk Cooling		½ H. P.	210 KWH per month for 100 gals. daily	8.40	16.80
Barn Lighting		200 to 1,000 Watts	5 to 30 KWH per month		.40 to 2.40
Poultry Lighting		120 watts per 100 hens	9 KWH per month per 100 hens		.72
Brooder	100 Chicks	220 watts	15 to 50 KWH per month	.60 to 2.00	1.20 to 4.00
Barn Pump		¼ to 1 H. P.	12 to 20 KWH per month	.48 to .80	.96 to 1.60

*Taken in part from data of the National Committee on Relation of Electricity to Agriculture.

PART II

QUESTIONS AND ANSWERS EXPLAINING HOW TO OBTAIN THE EXTENSION OF ELECTRIC SERVICE

1. Q. What is General Order No. 28 of the Public Service Commission?

A. It is an order generally applicable providing a plan for the extension of electric service which is uniform thruout the State and which has the hearty support of the agricultural associations and the electric industry. After several months of negotiation between committees representing the State Council of Agricultural Associations and the Pennsylvania Electric Association, their suggestions were submitted to the Public Service Commission with a joint petition that these suggestions be issued in the form of an order which was done after a hearing was held and certain modifications made.

2. Q. How far will electric companies run an extension?

A. The electric companies will extend service anywhere in their chartered territory provided they are guaranteed a monthly revenue as required under the schedules filed by them in compliance with the requirements of General Order No. 28.

3. Q. What is the guarantee of revenue required?

A. For at least 95 percent of the rural area of the State, the electric companies have filed a monthly guarantee of revenue of 2 percent or less on the cost of the extension. Thus, if an extension cost $2000.00 on a basis of 2 percent guarantee, the electric company would require a guarantee of monthly revenue of $40.00.

4. Q. How do consumers on an electric extension divide the guarantee of monthly revenue?

A. The guarantee of monthly revenue is divided among consumers in an equitable manner as provided in the company's filed schedules. In certain cases one or more consumers on the line may wish to assume more than his pro rata share of the guarantee in order to insure the building of the line. This method of apportioning the guarantee of monthly revenue is acceptable provided it is mutually agreed to by the consumers and the electric company.

5. Q. What rates are charged for electric current from an extension?

A. The urban rate schedules in force in the nearest municipality are applicable to consumers on the extension, subject to the guarantee of monthly revenue. Consumer may use current at these rates up to the amount of his guarantee of monthly revenue without additional charge.

6. Q. What is the effect on guarantee of monthly revenue if additional consumers are added to an existing extension?

A. The guarantee of revenue is reapportioned at least once a year. Consequently if new consumers are connected without an additional extension to an existing line, a reduction in the minimum guarantee of revenue is given the original consumers.

7. Q. How are laterals to an extension carrying guarantees of monthly revenue handled? What benefit do residents on any existing extension derive if another extension is built using the original as a source of electric current?

A. If the guarantee of monthly revenue of consumers on the lateral considered by themselves is in excess of the monthly guarantees of the consumers on the line, the lateral is considered and treated as a new and separate extension. If, however, the minimum guarantees of the new customers are less than the original consumers, the lateral is considered and treated as a part of the original line. Residents on an existing extension are thereby benefited by having their guarantee of monthly revenues lowered.

8. Q. What benefit, if any, do consumers derive by making contributions of cash, labor or materials for building the line?

A. While the applicant for service is not required to contribute toward the cost of the extension, he may do so in the form of labor, material or money. Whatever the amount of the contribution, it will reduce the original guaranteed monthly minimum proportionately. For example:—if a guarantee of monthly revenue on a 2 percent basis is $8.00, a contribution of $150.00 in cash or the equivalent in labor or material would give the customer a credit of $3.00 per month, thus reducing his guarantee to $5.00 per month.

9. Q. Can a farmer have all his electric service including lighting, cooking, refrigeration and motors metered on one meter and billed under one rate schedule?

A. Each company is required to file a rate schedule under which all farm service may be had thru one meter. Farmers and other applicants may take service under whatever other schedules are most advantageous to them, such as, residence lighting, small power or combined domestic service. It is the duty of the company to explain to the applicant the rate schedule which will give him service at the least cost.

10. Q. What are the terms of the contract for electric service which consumers must sign?

A. The term of contract is for a period of three years. The minimum monthly guarantee that the applicant agrees to pay will not be increased during this period of time but may be decreased as explained above. At the end of the three years a new contract will be negotiated between the company and the applicant. The minimum monthly guarantee charged at the end of the contract period will be continued unless changes will have taken place that require a new set-up of the monthly guarantee of revenue. It is hoped that during the three year period the consumption of current on the different extensions will become sufficiently large that the question of the monthly minimum will cause no difficulty.

11. Q. How are standards of construction of line extensions determined?

A. The Order provides "All line extensions shall be constructed, maintained and operated in such manner as to be reasonably adequate and practically sufficient for the accommodation and safety of consumers, employes and the public. The Commission upon its own initiative, or upon complaint may cause any line extension to be inspected and may determine whether or not such line extension is or is not so constructed, maintained and operated." Each company follows specifications which its experience has demonstrated as necessary for safe construction and good service. This has resulted in quite a wide range of standards for extensions. The Electric Companies are finding it desirable to rearrange their construction standards for strictly rural lines, in order to keep the cost down.

12. Q. How would applicants living some distance back from the highway obtain service?

A. Applicants not on a public highway are required to extend their own line to within one service span of the public highway along which the extension is being made. Before building his connecting line, the applicant should consult with the company as to the specifications he should follow in the construction of his line, for service will not be furnished over a line that is not properly constructed from the standpoint of safety and good service.

13. Q. What is being done to assist rural consumers in the extension of electric service to them?

A. During the negotiations between the committees representing the farm organizations and the electric industry, it was recognized that questions of interpretation of the order, agreements as to rates and extension plans, the adjustment of informal complaints, methods of building up electrical loads on extensions, and various other matters would present themselves from time to time. To take care of this, machinery has been set up whereby these difficulties could be handled in a businesslike way between the interested parties. As a result the Pennsylvania Joint Committee on Rural Electrification was organized as shown on page 2.

Offices of the Joint Committee have been established at 707 Telegraph Building, Harrisburg, Penna., with John M. McKee as Executive Secretary.

All informal complaints or inquiries involving line extensions being built or projected under General Order 28 are handled by the Joint Committee. The applicant or complainant is informed fully as to the provisions of General Order 28. His case is called to the attention of the light and power company serving that area and the two are brought together in an endeavor to bring about a mutually satisfactory agreement.

The engineers of the Public Service Commission cooperate with the Joint Committee in problems arising in connection with these extensions. In case of a question as to proper specifications of a line or as to cost estimates, these engineers are consulted and in some cases go where the extension is to be built and confer with the electric company and the applicants. In this way it is possible to save the applicant the expense and delay that would be involved in the case of a formal complaint and at the same time bring about a settlement that is fair to all parties concerned. In case it is not possible to reach an adjustment, the applicant still has the privilege of filing a formal complaint with the Public Service Commission.

Through the efforts of the Joint Committee, the electric companies are establishing agricultural departments as important parts of their organizations. The electric companies are now equipped to give prompt replies as to conditions under which service can be rendered from a proposed extension.

14. Q. What is the first step to be taken where electric service is desired?

A. Applicants should request the company operating in their territory for an estimate as to the cost and condition under which service will be extended. The company will check the length of extension required and the probable number of consumers. If there appears to be a reasonable prospect of securing a sufficient number to guarantee the required monthly revenue, the company will then make the necessary engineering survey and estimate the cost of the line extension. A guarantee of revenue based on an estimated cost is submitted to the group. It then becomes a question whether the group desiring service are willing to meet the required guarantee of monthly revenue. To extend service to the thinly settled rural districts at a cost within the reach of the consumers is difficult and requires the fullest cooperation of all parties. Applicants can help greatly and minimize costs by assisting in securing signatures to contracts for service and for rights-of-way, as well as thru the contribution of labor in hauling poles, digging holes, tree trimming, etc.

If there are any points that are not clear or an agreement cannot be reached, the service of the Joint Committee should be enlisted.

15. Q. What does a mile of line cost?

A. It is not possible to give off hand the exact cost of a mile of line since this varies due to construction conditions, such as blasting of rock, tree trimming, over-building or moving of telephone lines, railroad crossings, etc. The cost of construction is contingent on such variable items as the length of poles, the distance between poles, the voltage of the line, necessity for single phase or three phase line, etc. Cost estimates for distribution and supply lines thruout the State covering a wide range of conditions and construction specifications vary from $1200 to $5000 per mile.

16. Q. What check do consumers have on estimates of cost?

A. Of necessity electric companies must base their estimates of cost on past experience for similar line extensions in the territory in which the proposed extension is to be built. The consumers on an extension have the option of having it built by reliable contractors in accordance with specifications of the company with the understanding that the electric company will purchase and take title to the line and reimburse the applicants at an agreed upon cost, provided that such cost is less than the company's estimated cost of construction. The applicants for electric service should keep in mind that the company's estimate is based on a complete line ready for service including transformers, service wires and meters. The contractor's estimate would probably be for a bare line without these additional items and without items such as engineering, surveying, tree trimming and permit fees. Therefore, the gross cost of the line on which the guarantee of revenue would be figured might be considerably more than the contract price for constructing the bare line.

In those cases where the electric company and the applicants are unable to agree because of difference of opinion regarding cost estimates, the joint committee may be called in consultation. For these cases detailed cost estimates is furnished to the joint committee. These are checked by the engineers of the Public Service Commission. If deemed necessary they go over the line extension accompanied by a representative of the joint committee and of the electric company to check all questions involved.

17. Q. Does the minimum monthly guarantee payment of 2 percent on the cost of the extension pay for the line in approximately four years?

A. No. The 2 percent per month on the cost of the extension is the amount estimated as necessary for the company to receive in order to maintain service on the line permanently and must provide for such items as interest, depreciation, maintenance, taxes, insurance, line and transformer losses and commercial expenses, such as billing and meter reading. The 2 percent per month or 24 percent per year is a gross revenue and does not pay for the line in four years any more than a gross return of $25 per acre on a crop of wheat, which would be 25 percent of the cost of the land, would pay for land valued at $100 an acre in four years. The $25 per acre gross return on the wheat would probably just about pay for the cost of production under Pennsylvania conditions. In a similar way the 2 percent per month is necessary to cover the gross cost of service.

18. Q. Is the electric service furnished in the country the same as in the city?

A. The service is the same in the country as in the city. However, due to the fact that there are only from three to ten customers per mile in the rural districts, it is necessary that they assume a larger guarantee of monthly revenue than in the city where the number of consumers commonly ranges from fifty to one hundred or more per mile and the company is assured of a monthly revenue per mile of line much greater than the 2 percent monthly guarantee basis established for rural lines. In every other way the service is similar. City rates are moved out to the country.

PART III

WIRING THE FARMSTEAD

GOOD WIRING NECESSARY FOR THE BEST SERVICE

The responsibility for the adequacy of the farm wiring system rests with the owner. How can he make sure of obtaining a complete wiring system? Experience is proving that many of the wiring jobs, while meeting safety standards, are not proving adequate to carry the service desired. As a guide to the farmer installing a new wiring system or to the one who wishes to change his present layout for the sake of greater convenience and load carrying capacity, a brief outline of what should be considered in securing a good wiring installation is provided. A careful study of the suggested model plans, room by room and building by building as given later will avoid many oversights and result in a much more convenient system.

The wiring system of an electrical installation is the foundation which determines the uses to which electricity can be put and the convenience of its application.

Just as a lack of good roads prevents the automobile from attaining its greatest usefulness in many rural districts, so lack of complete and adequate wiring on the farm will prevent the farmer from using electric service to its fullest advantage in lighting the buildings and grounds and in doing the manifold tasks of household work and farm chores such as grinding feed, milking cows, cooling milk, pumping water and cutting wood.

If the farmer is the owner, a complete wiring system makes it possible for him to have light and power where it will give the most efficient service and under convenient and easy control. It will enable him to do the farm chores in less time and with more satisfaction with the final result of his earning a larger income. It will keep him abreast of the progress in other lines of industry where power is used to a maximum, thus greatly increasing the output per man, in other words, resulting in a saving of labor.

If the farmer rents his farm, a complete wiring system will pay him interest both in the form of increased rental and in securing a better tenant. When the farmer wishes to sell his property, a good wiring system will better the opportunity for a sale and increase the selling price.

It is well to consider that the investment in a good wiring system results in a permanent improvement continuing to give service year after year without changes or any more expense. If an inadequate wiring system is installed, it will not be long before additional expenditures will be necessary in order that electricity can be used to the fullest advantage.

There is a fairly wide choice among the systems of wiring that are approved by the National Board of Fire Underwriters. The permanence, completeness and convenience of the system, however, is to be determined by the owner. The electric company can be of great assistance to the owner in preparing the specifications for the wiring system, preliminary to asking for bids. As a public utility organized to furnish electric service, it is their responsibility and desire to assist their customers in securing the most satisfactory use of electricity. Their knowledge gained through years of experience will be valuable to him in avoiding costly mistakes and providing for a wiring system that will be economical and yet complete. Every company has certain requirements, which experience has proven necessary that they enforce before they will connect service, one of which is that the wiring be inspected and approved as safe by the National Board of Fire Underwriters.

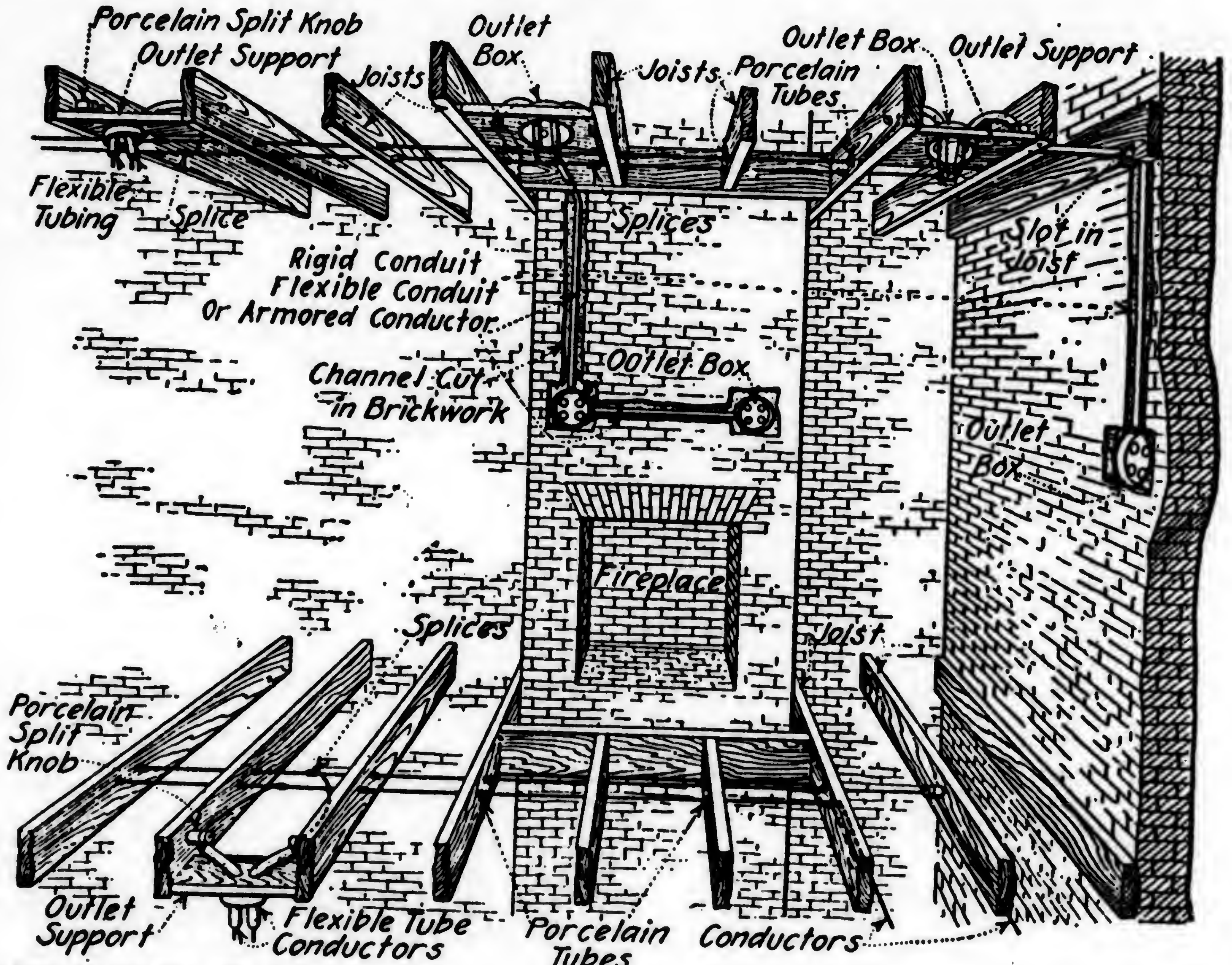
Meter Box on Pole

The plans and specifications for the wiring system having been carefully worked out, it is important to secure bids from reliable contractors. There are many ways in which a contractor of doubtful standing may reduce his bid through poor workmanship and an incomplete job and by using materials below standard. Therefore, the best protection, as in any other business contract, is to deal only with contractors who have earned a reputation for dependability and good work. No bids should be considered unless you feel certain you will have good workmanship and the installation will be made in strict compliance with the National Electrical Code.

STANDARD WIRING PRACTICES

Two kinds of insulated copper wire are commonly used in wiring: First—**rubber covered insulated** wire (known as RC Wire) which is used in indoor installations; Second—**weatherproof** wire (known as WP Wire) to be used only in out-door construction.

Various methods of installation are in common use, and while all have their particular application, it is necessary that their advantages and disadvantages be recognized.



—Courtesy McGraw Hill Book Co. Inc.

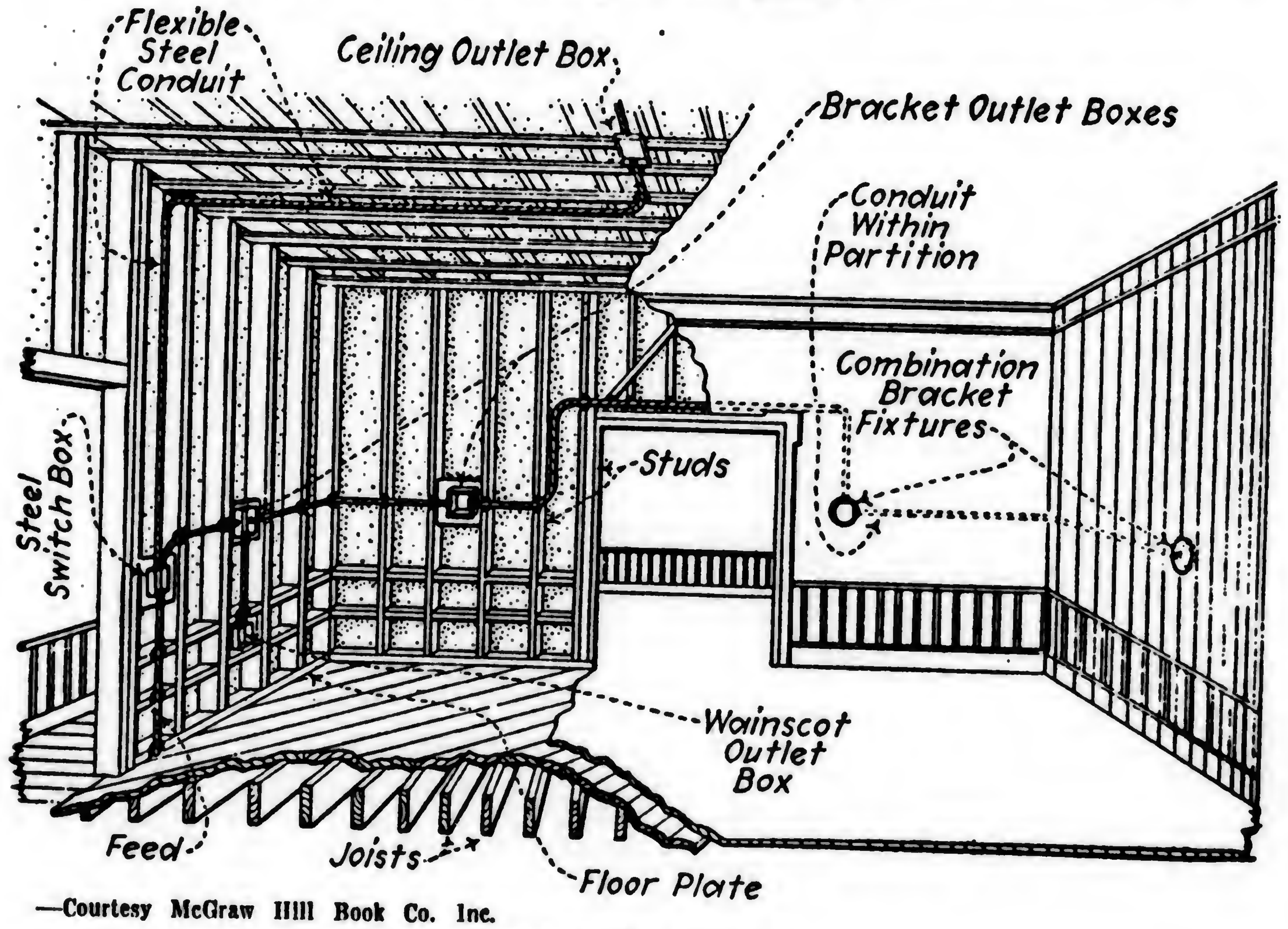
Knob and Tube and Rigid Conduit Wiring.

"Knob and Tube" Construction: This system receives its name from the fact that the insulated wires are carried on a series of porcelain knobs attached to the beams of the building. If run perpendicular to the beams, holes are bored in the latter and porcelain tubes with shoulders at one end, inserted in the holes through which the wires are passed. When it becomes impracticable to support the wires on porcelain knobs or through porcelain tubes, they are enclosed in a flexible circular fireproof casing known as "loom," which must be continuous from outlet to outlet.

This method of wiring should be limited to house installations as far as possible because it is subject to mechanical injury, such as interference from rats and mice or damage by animals.

Flexible Armored Cable (BX) Construction: "BX" or flexible armored cable is made by enclosing rubber insulated wire in a jacket of spirally wound sheet steel strips. It is then merely a flexible conduit with one, two or three wires, as the case may be, already installed within it. The wires cannot be withdrawn from the casing. The higher material cost of the "BX" is offset by the lower labor cost of installation so that the total material and labor cost should be roughly the same for "BX" construction as for knob and tube work.

"BX" Cable is not moisture proof and therefore should not be used in damp locations. A weatherproof cable, known as "BXL," has an extra casing of lead with the same protective covering as "BX" and can be used in damp or wet places.



—Courtesy McGraw Hill Book Co. Inc.

BX Cable Wiring.

This type of wiring installation is recommended as good construction for dry locations in the barn or house.

Rigid Conduit Installations: "Rigid Conduit" is a system in which insulated rubber-covered wires are enclosed in rigid metallic pipe, similar to a gas or water pipe, except special precautions are taken to free it inside from scale or any irregularities. It is then coated inside with enamel and either enameled or galvanized on the outside. A good rigid conduit system is water proof. It is almost impossible, however, to wire an old building throughout with rigid conduit without a great deal of cutting and damaging of walls and ceilings. It is seldom used in wiring a finished house for that reason.

Rigid conduit can be installed exposed along beams and walls, and has a decided application in the wiring of barns and other outbuildings, in locations exposed to moisture. The service entrance to all farm buildings should be in rigid conduit.

Non-Metallic Sheathed Cable Installation: Non-metallic sheathed cable is a new material used in practically the same manner as the flexible armored cable (BX), the difference being that in this type of wiring, the wires are enclosed in a flexible non-metallic tubing. This tubing is coated with a weatherproof and fire resisting compound and affords excellent protection.

Such cable is suitable for residences where other types of wiring are not required by the Underwriters' Code.

Outdoor Construction: For wiring outside, weatherproof wire should be used and must be properly supported on outdoor insulators. Care must be taken that this wire is replaced by a rubber-covered wire at the last outdoor support where the wiring system enters a building.

PREPARING FOR THE ELECTRIC COMPANY'S SERVICE

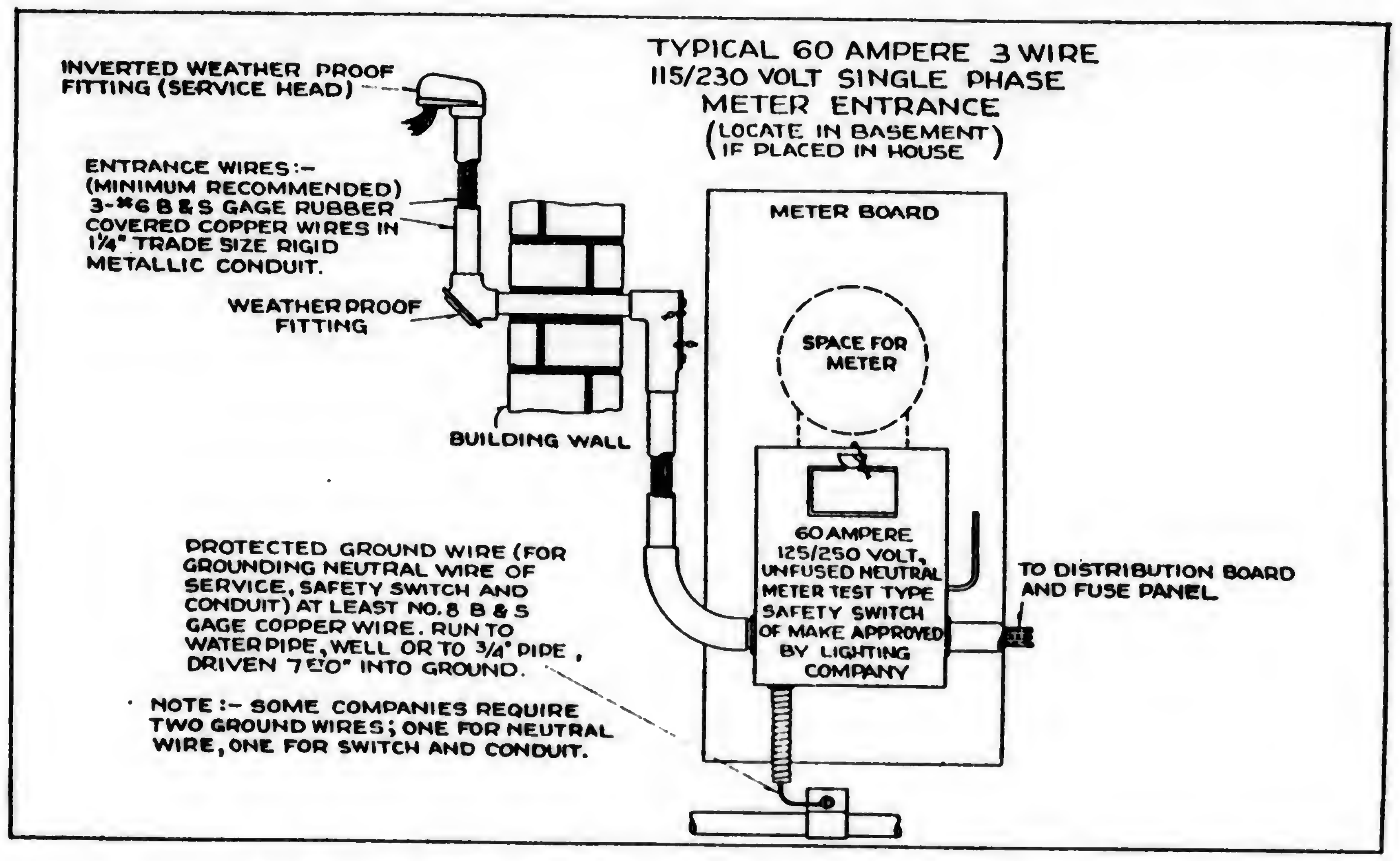
All of the wiring methods described are applicable to farm wiring. There are, however, many other details that should be considered to insure an adequate system.

Entrance for Lighting Company's Service: The entrance wires, preferably three in number, carry the electric energy from the electric company's service line to the meter. The entrance is an essential part of the wiring system. It is the neck of the bottle and it can either hinder or help the farmer in his use of electricity. If constructed of small wires the use of electric service is limited; if, however, the wires are of the proper size, large enough to carry all of the load, with proper allowance for future uses, electricity can then serve to the best advantage and will become an asset.

For these reasons it is strongly recommended that the entrance wires should not be less than three No. 6 B. & S. (Brown and Sharpe) gage, rubber-covered double braid, copper wires, installed in 1¼" trade size rigid metallic conduit. This entrance will provide for 3 wire, 115/230 volt, alternating current service.

In exceptional cases where only the ordinary small lighting load will be used, two No. 8 B. & S. gage rubber-covered double braid copper wires can be installed in ¾" trade size rigid metallic conduit.

Main Entrance Switch: For the same reason that the entrance should have large size wires, the main entrance switch should be of large capacity. One without the other is of no value, and for that reason the minimum size of main entrance switch recommended for a farm is a 60 ampere, 125/250 volt, unfused neutral meter test type safety switch.


TYPICAL 60 AMPERE 3 WIRE
115/230 VOLT SINGLE PHASE
METER ENTRANCE
(LOCATE IN BASEMENT IF PLACED IN HOUSE)
INVERTED WEATHER PROOF FITTING (SERVICE HEAD)
ENTRANCE WIRES:- (MINIMUM RECOMMENDED) 3-#6 B & S GAGE RUBBER COVERED COPPER WIRES IN 1¼" TRADE SIZE RIGID METALLIC CONDUIT.
WEATHERPROOF FITTING
BUILDING WALL
METER BOARD
SPACE FOR METER
60 AMPERE 125/250 VOLT, UNFUSED NEUTRAL METER TEST TYPE SAFETY SWITCH OF MAKE APPROVED BY LIGHTING COMPANY
TO DISTRIBUTION BOARD AND FUSE PANEL
PROTECTED GROUND WIRE (FOR GROUNDING NEUTRAL WIRE OF SERVICE, SAFETY SWITCH AND CONDUIT) AT LEAST NO. 8 B & S GAGE COPPER WIRE. RUN TO WATER PIPE, WELL OR TO ¾" PIPE, DRIVEN 7'0" INTO GROUND.
NOTE:- SOME COMPANIES REQUIRE TWO GROUND WIRES; ONE FOR NEUTRAL WIRE, ONE FOR SWITCH AND CONDUIT.

60-Ampere, 3 Wire Single Phase Meter Entrance.

In exceptional cases where a small entrance is installed as noted above, a 30 ampere 125 volt, meter test type safety switch can be used.

When installing an entrance on the farm, care should be exercised to see that the entrance, including the main entrance switch conforms to the requirements of the electric service company.

Where it is desired to take full advantage of electric service, a distribution board should be placed adjacent to the main switch. This consists of a sheet steel box containing the 60 ampere fuses for the feeders to the barn and other out-buildings, and a set of fuses of proper size to protect the wires to the house panel board, which can be chosen in accordance with the suggestions that follow.

In addition a 60 ampere fused safety switch should be installed alongside the main switch to control the wires (feeders) to the electric range. The sheet steel cabinet and two sets of fuses for barn and house panel board may be replaced by separate safety switches, if so desired, all fed from the main switch.

WIRING THE HOUSE

Branch Circuit Panel Board: At the distribution panel or fuse box, each of the various sets of wires (branch circuit conductors) leading to the outlets in the house is protected by fuses, and sometimes by switches. As explained below, it is suggested that not more than nine outlets be placed on one set of wires (branch circuit) leading away from the panel. This provides a means of checking the size required. The number of circuits should be the total number required at the present time, together with several extra places for future circuits. It is suggested that the electric company or a qualified electrical contractor be asked to check the details of the panels.

Feeder to Panel Board: The feeder from the main switch or the distribution board to the house panel board consists usually of three rubber covered wires enclosed in rigid conduit, or "BX" Cable.* It carries the current from the main entrance switch to the panel board.

The wires of this feeder should be run in accordance with the following table:

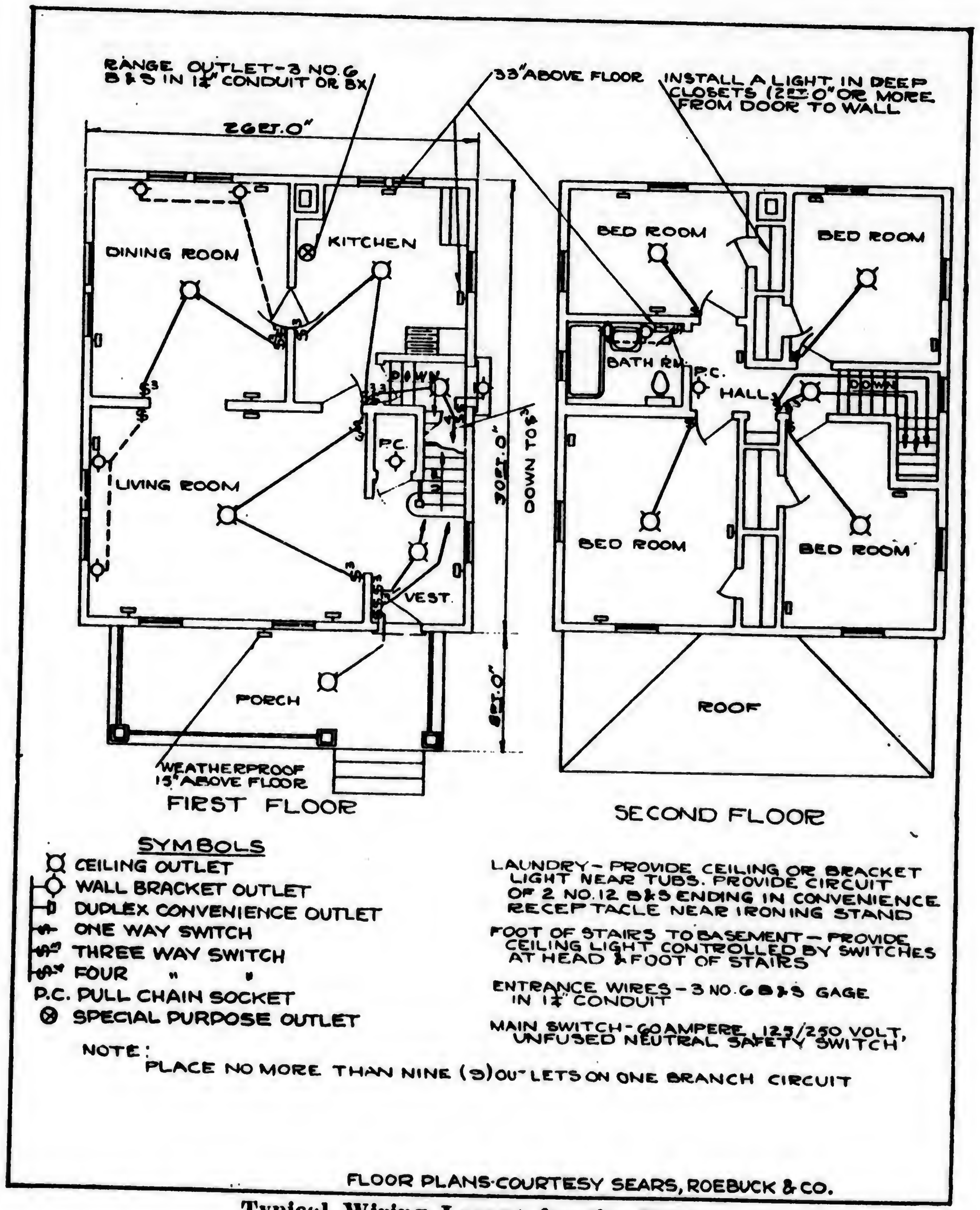
Number of circuits leading from the panel board to various parts of the house	Size of the rubber covered copper wire	Number of wires necessary	Size of the Rigid Conduit in inches
4 Circuits	No. 8 (B & S)	2	¾ inch
4 Circuits	No. 10 (B & S)	3	¾ inch
6 to 8 Circuits	No. 8 (B & S)	3	1 inch
10 to 12 Circuits	No. 6 (B & S)	3	1-¼ inch

Number of Outlets per Circuit: It is recommended that not over nine (9) outlets be placed on any circuit. Switch openings are not considered outlets for this purpose.

Wire Sizes for Circuits: It is urged that no wire smaller than No. 12 (B. & S.) gage be used for convenience outlet circuits in the farm house. The small difference in cost between No. 12 and No. 14, (the smallest size permitted by the National Electrical Code), is more than outweighed by the advantages gained.

Number of Outlets per Room in the Farm House: In the "Minimum Wiring Recommendations for the Average Farm House," will be found a tabulation of ceiling, wall bracket and convenience outlets, and lamp sizes for each room of the house. The outlet recommendations are based on a nationally recognized non-commercial standard which has been tried and proved successful in thousands of homes of the United States and Canada for the past three or four years.

Location of Outlets: Ceiling lighting outlets should usually be centered in the room.


RANGE OUTLET-3 NO.6 B&S IN 1¼" CONDUIT OR BX
33" ABOVE FLOOR
INSTALL A LIGHT IN DEEP CLOSETS (2 FT. 0" OR MORE FROM DOOR TO WALL
26 FT. 0"
DINING ROOM
KITCHEN
LIVING ROOM
P.C.
DOWN
30 FT. 0"
DOWN TO 3
VEST.
PORCH
8 FT. 0"
WEATHERPROOF 15" ABOVE FLOOR
FIRST FLOOR
BED ROOM
BED ROOM
BATH RM.
P.C.
HALL
DOWN
BED ROOM
BED ROOM
ROOF
SECOND FLOOR
SYMBOLS
CEILING OUTLET
WALL BRACKET OUTLET
DUPLEX CONVENIENCE OUTLET
ONE WAY SWITCH
THREE WAY SWITCH
FOUR " "
P.C. PULL CHAIN SOCKET
SPECIAL PURPOSE OUTLET
LAUNDRY - PROVIDE CEILING OR BRACKET LIGHT NEAR TUBS. PROVIDE CIRCUIT OF 2 NO.12 B&S ENDING IN CONVENIENCE RECEPTACLE NEAR IRONING STAND
FOOT OF STAIRS TO BASEMENT - PROVIDE CEILING LIGHT CONTROLLED BY SWITCHES AT HEAD & FOOT OF STAIRS
ENTRANCE WIRES - 3 NO.6 B&S GAGE IN 1¼" CONDUIT
MAIN SWITCH - 60 AMPERE, 125/250 VOLT, UNFUSED NEUTRAL SAFETY SWITCH
NOTE: PLACE NO MORE THAN NINE (9) OUTLETS ON ONE BRANCH CIRCUIT

FLOOR PLANS·COURTESY SEARS, ROEBUCK & CO.

Typical Wiring Layout for the House.

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*Feeders may also be run with "knob and tube" work.

*MINIMUM RECOMMENDATIONS FOR OUTLETS AND LAMP SIZES

(To Assure Satisfaction, Convenience and Comfort)

Rooms	Ceiling Lights				Side Lights				Switch	One Way	Switch	Three Way	Convenience Outlets		Special	Outlet
	Recommended number and proper size of lamp		Planned number and the size of lamp		Recommended number and proper size of lamp		Planned number and the size of lamp		Recommended number	Planned number	Recommended number	Planned number	Recommended number	Planned number	Recommended number	Planned number
	Outlets	Lamps per fixture	Outlets	Lamps per fixture	Outlets	Lamps per fixture	Outlets	Lamps per fixture								
A Entrance or Porches	1	1-50 W			or 1	1-50 W			1				1			
Vestibules	1	1-50 W							1							
B Lower Hall	1	1-50 W			or 2	1-40 W					2		1			
Living Room	1	5-60 W			2	1-40 W			1				4			
Dining Room	1	4-50 W			2	1-25 W			1				2			
C Kitchen	1	1-100 W			1	1-50 W			1				2		1	
Summer Kitch	1	1-100 W			1	1-50 W			1				2			
D Upper Hall	1	1-40 W			or 1	1-40 W			2		2		1			
Bath Room					2	1-40 W			1				1			
Bed Room 1	1	3-60 W			or 2	1-40 W			1				3			
Bed Room 2	1	2-60 W			or 1	1-60 W			1				2			
Bed Room 3	1	2-60 W			or 1	1-60 W			1				2			
Bed Room 4	1	2-60 W			or 1	1-60 W			1				2			
Clothes Closets	1	1-25 W							1							
Attic	1	1-50 W							1				1			
E Laundry	1	1-100 W							1				1		1	
Fruit Cellar	1	1-50 W														
Water Closet	1	1-40 W														
Furnace Cellar	1	1-50 W							1							
F Garage	1	1-60 W									2		1			

A—The convenience outlet recommended should be installed on porch between main house and summer kitchen.

B—One 3-way switch to be located in lower hall, one 3-way switch to be located in upper-hall—both controlling ceiling light.

C—A special outlet is recommended for an electric range.

D—One 3-way switch to be located in upper hall, one 3-way switch to be located in lower hall—both to control ceiling light.

E—Special circuit of not less than No. 12 B & S wire terminating in a suitable receptacle for electrically heated ironing machine.

F—One 3-way switch to be located at house and one 3-way switch to be located at garage—both controlling garage light.

Notes: All convenience outlets are recommended to be installed with duplex receptacles interchangeable type conveniently located.
The main entrance should be 3 wire No. 6 B & S gage, enclosed in 1-¼" rigid conduit, with a 60-ampere-3 pole 250 volt-main entrance switch.
It is recommended that all wall switches and convenience outlets be of the flush type.
In case of rooms having two entrances, the installation of a three-way switch at each entrance is highly recommended.

*Outlet recommendation taken from "Electric League of Pittsburgh" Standards.

Wall brackets are usually located 5 feet above the finished floor in bedrooms and 5½ feet in all other rooms.

Convenience outlets in the kitchen and bathroom should be about 33 inches above the floor. In all other locations they are usually best placed just above or in the baseboard.

Wall switches are usually located four feet above the finished floor.

Switching: It should not be necessary to stumble across a dark room or hall in order to turn on a light. A switch should be located at each door to a room or entrance to a hall. This means that in some cases such as dining rooms, upper and lower halls and living rooms it is necessary and desirable to install what is known in the electrical trade as "a set of 3-way switches" which afford control over the same light from two separate locations.

An electrical installation is not convenient or satisfactory unless the lights are properly switched.

Electric Range Circuit: Where an electric range is to be installed immediately, or there is likelihood of one being used within a reasonable time, it is urged that three No. 6 B & S gage rubber covered double braid wires in 1¼" conduit or in BX Cable be taken from the main switch or distribution panel to the range location. This conduit should end about six inches above the floor in a suitable fitting.

For a small range of not over 5500 watt capacity, this feeder may be three No. 8 wires in 1-inch conduit or BX Cable provided the length of run is not over twenty-five feet.

Laundry Circuit: To provide for an electrically heated ironer in the laundry a separate branch circuit of two No. 12 B & S gage wires should be taken from the panel board to a suitable location in the laundry and terminated in a convenience outlet receptacle.

Fusing: Fuses are the safety valves of an electrical system. Under no circumstances should fuses larger than 15 ampere capacity be placed on lighting or convenience outlet circuits with exception of the laundry circuit where a 20 ampere fuse may be used.

To use fuses larger than 15 ampere or to substitute pennies or other devices to replace the fuse is to invite trouble. If it proves impossible to keep a 15 ampere fuse from blowing when the lighting and appliance load on that circuit apparently is not too great for the fuse, it indicates a defective appliance or appliance cord or wiring trouble in the circuit itself. Small capacity fuses localize trouble. If large fuses or substitutes are used the main fuse will blow, thus putting all the circuits out of service.

The Proper Use of Lamp Sockets and Convenience Outlets: Lamp sockets in fixtures should, as their name indicates, be used for lamp bulbs and not for connecting appliances, portable lamps, radio sets, etc. Duplex convenience outlets are provided in the well-wired farm home for the latter, as fixtures usually are not built either mechanically or electrically to withstand the abuse to which they are put when appliances are plugged into the lamp socket. A duplex outlet provides two places for the attachment of lamps or appliances at a cost only slightly greater than that of the single outlet.

The Minimum Size Wire to Be Used: The **National Electrical Code** specifies that no wire smaller than No. 14 B & S gage shall be used for lighting or appliance branch circuits. In no case should temporary or permanent extensions to a wiring system be made with lamp cord, telephone wire, bell wire or other substitutes for the material specified in the Code. It should not be necessary to bring extensions from one convenience outlet around the entire room to supply floor or table lamps in the opposite corner. Enough convenience outlets should be installed so that any portion of the wall space can be reached with a six-foot extension cord.

WIRING THE BARN AND OTHER OUTBUILDINGS

Wiring Method

Such parts of barns and other outbuildings as are frequently sprayed or which have a tendency to moisture should be wired in rigid metallic conduit to prevent premature deterioration of the system and to avoid trouble due to short circuits and grounds. Those parts of buildings not subject to manure fumes nor to moisture may be wired with "BX" Cable.

It is recommended that rigid conduit or "BX" Cable be used for all barns and outbuildings as a safeguard against rats and to prevent damage to the wiring from cattle, tools, etc.

Sockets and Fittings

Porcelain or **weatherproof** sockets should be used in barns, as the ordinary brass shell socket will not give good service if dampness is present. Conduit and "BX" Cable fittings should be moistureproof.

Location of Outlets

Switches and convenience outlets should be placed as high up on the wall as can comfortably be reached and kept away from livestock runways, interior drive ways and other locations where they may be damaged. All lighting outlets should be so placed that cattle cannot come in contact with them. If this proves impossible, as may be the case in low ceiling barns, suitable wire guards should be placed over the fixtures.

Lighting and Convenience Outlet Circuits

Wire Size: No wire smaller than No. 12 B & S gage should be used in wiring barns and other outbuildings.

Safety Switch: It is recommended that a fused safety switch be placed at the entrance to each barn or building of any size to take out of service all wires within the building. If more than one circuit is required each circuit should be properly fused at the switch.

Location Switches: Where more than three or four lights are installed they should be switched by local switches in convenient groups. Three-way switches are just as useful in the barn as in the house.

Power Circuits

Motor Sizes: The "Table Showing The Right Size of a Motor to Use" indicates motor sizes which are most commonly used for various power operations about the farm.

Wiring for Permanently Located Motors: The table entitled "Wiring Data for Single Phase Motors" indicates the proper size of wire, the proper size of fuse and of safety switch to use with motors of various sizes.

Power Outlets for Portable Motors: Portable motors of 115 volts rating up to and including 1/4 horse power may be plugged into the nearest convenience outlet.

For 230 volts, single phase motors up to 3 H. P. capacity, provide a 2-wire, 30 ampere, 230 volt weather-proof type plug receptacle. The wiring to this receptacle should be 2 No. 8 B & S gage wires in 3/4" rigid conduit or in BX Cable depending on the location. It should be protected by a 30 ampere switch.

For 5 H. P. single phase, 230 volt motors furnish 2-wire, 60 ampere, 230 volt weatherproof type plug receptacle. The wiring should consist of 2 No. 6 B & S gage rubber covered wires in 1" conduit or BX Cable depending on the location. It should be protected by a 60 ampere switch, properly fused.

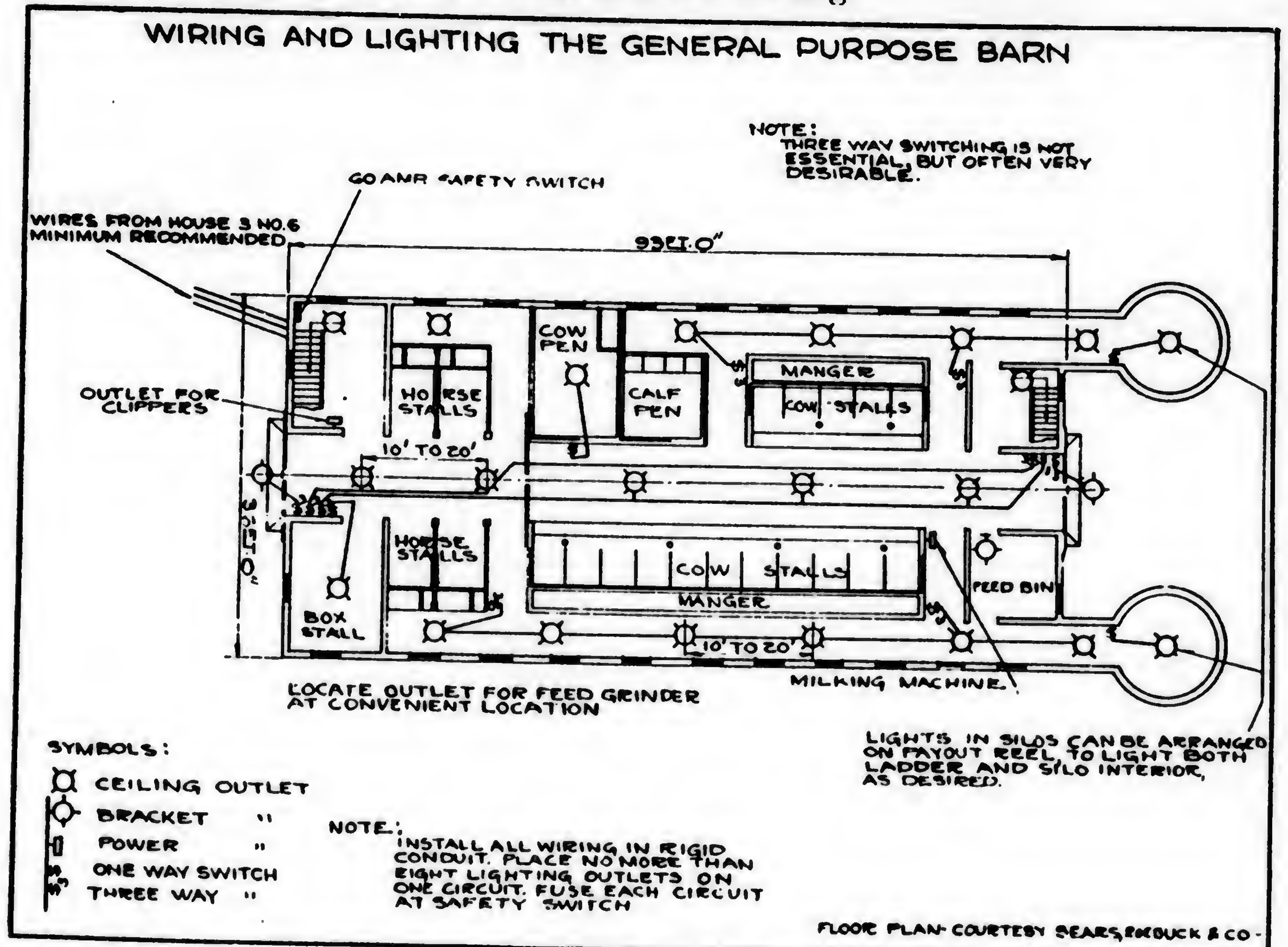
WIRING THE BARNYARD AND GROUNDS

All wire installed out of doors and not in conduit should be protected by insulation known as "weatherproof." Rubber insulation will not stand up under the elements and for this reason should never be used out of doors unless protected by rigid metallic conduit. "BX" Cable should not be used out-of-doors.

For mechanical strength to withstand wind, snow and sleet, no wire smaller than No. 8 B & S gage should be used out of doors, even though this size may not be necessary for current carrying capacity. Where the load to be carried is greater than the capacity of No. 8 as shown in the table, larger size wire should be used.

The wires in the center of a span between supports should never be closer than 10 feet to the ground. Over driveways, private roads, in the barnyard where teams may be driven, etc., wires in the open should not be closer than 15 feet to the ground. For road crossings where large loads of hay or grain will be hauled the height of the wire should be sufficient to leave ample clearance above a man standing on top of the load.

Chestnut poles about 20 or 25 feet in length can be set and pole brackets used for supporting wires in the farm yard. Where wires enter a building they can be supported on racks or house brackets, or may be tied to a glass or porcelain insulator mounted on a "wood pole pin" attached to the side of the building.



WIRING AND LIGHTING THE GENERAL PURPOSE BARN

NOTE:
THREE WAY SWITCHING IS NOT ESSENTIAL, BUT OFTEN VERY DESIRABLE.
60 AMP. SAFETY SWITCH
WIRES FROM HOUSE 3 NO. 6 MINIMUM RECOMMENDED
93 FT. 0"
OUTLET FOR CLIPPERS
HORSE STALLS
COW PEN
CALF PEN
MANGER
COW STALLS
10' TO 20'
36 FT. 0"
HORSE STALLS
BOX STALL
COW STALLS
MANGER
10' TO 20'
FEED BIN
MILKING MACHINE
LOCATE OUTLET FOR FEED GRINDER AT CONVENIENT LOCATION
LIGHTS IN SILOS CAN BE ARRANGED ON PAYOUT REEL, TO LIGHT BOTH LADDER AND SILO INTERIOR, AS DESIRED.
SYMBOLS:
CEILING OUTLET
BRACKET "
POWER "
ONE WAY SWITCH
THREE WAY "
NOTE:
INSTALL ALL WIRING IN RIGID CONDUIT. PLACE NO MORE THAN EIGHT LIGHTING OUTLETS ON ONE CIRCUIT. FUSE EACH CIRCUIT AT SAFETY SWITCH

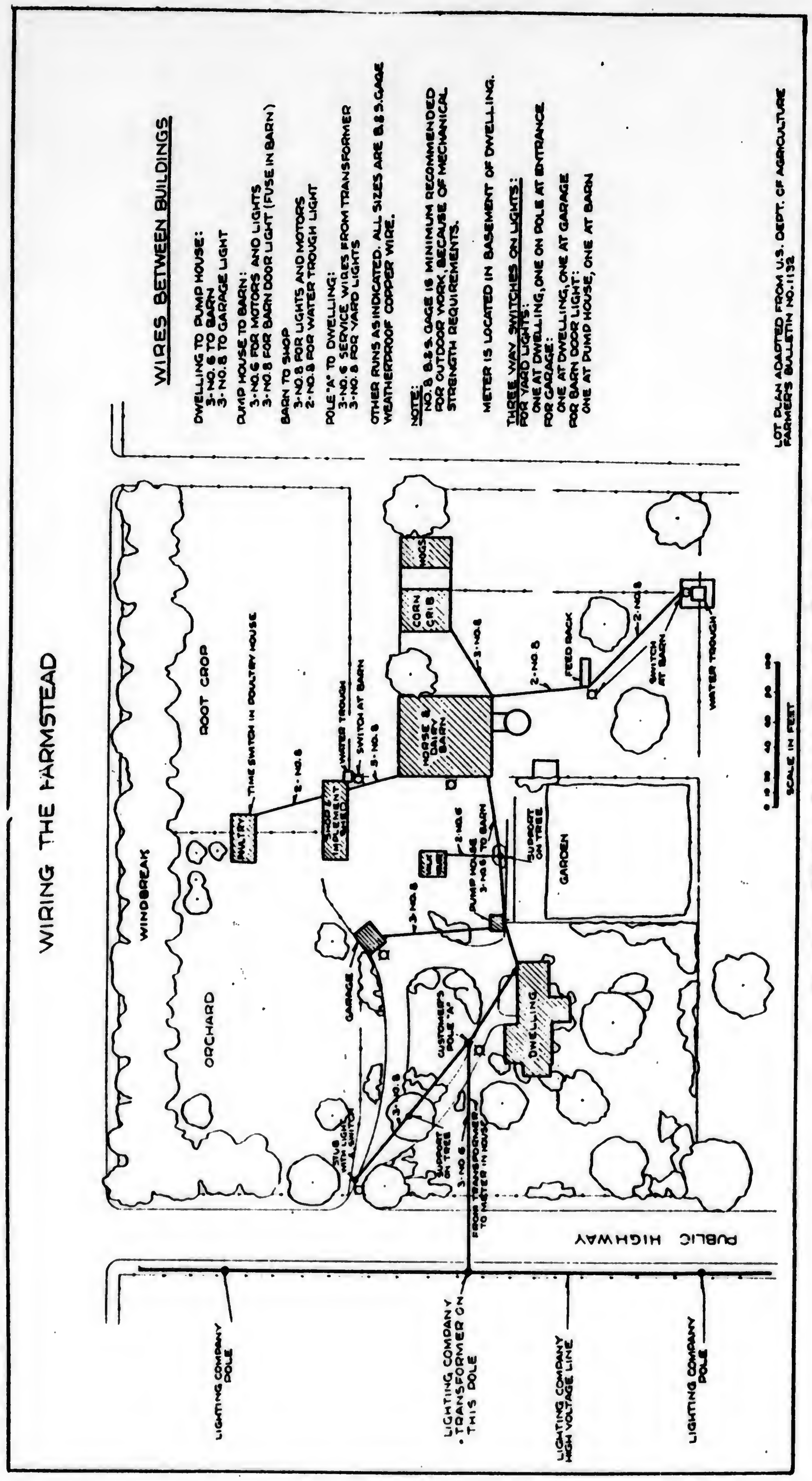
FLOOR PLAN-COURTESY SEARS, ROEBUCK & CO.

Wires can be brought into a building through separate porcelain tubes, which should be installed slanting down toward the outside or may be brought in in rigid conduit. If conduit is used all wires of the same circuit must be carried through the wall in one conduit.

All light sockets installed out doors for yard lighting should be of weatherproof type rather than the ordinary brass shell socket as is used in interior house wiring. Fittings should be moistureproof.

RECOMMENDATIONS FOR LIGHTING BARN AND OTHER OUTBUILDINGS

Definite recommendations for lighting the barn and other buildings such as those shown for the farm house, are difficult to tabulate because of the wide variation in construction and use. The wiring plans and the notes on proper lighting given here should help materially in laying out the electrical system for such buildings.

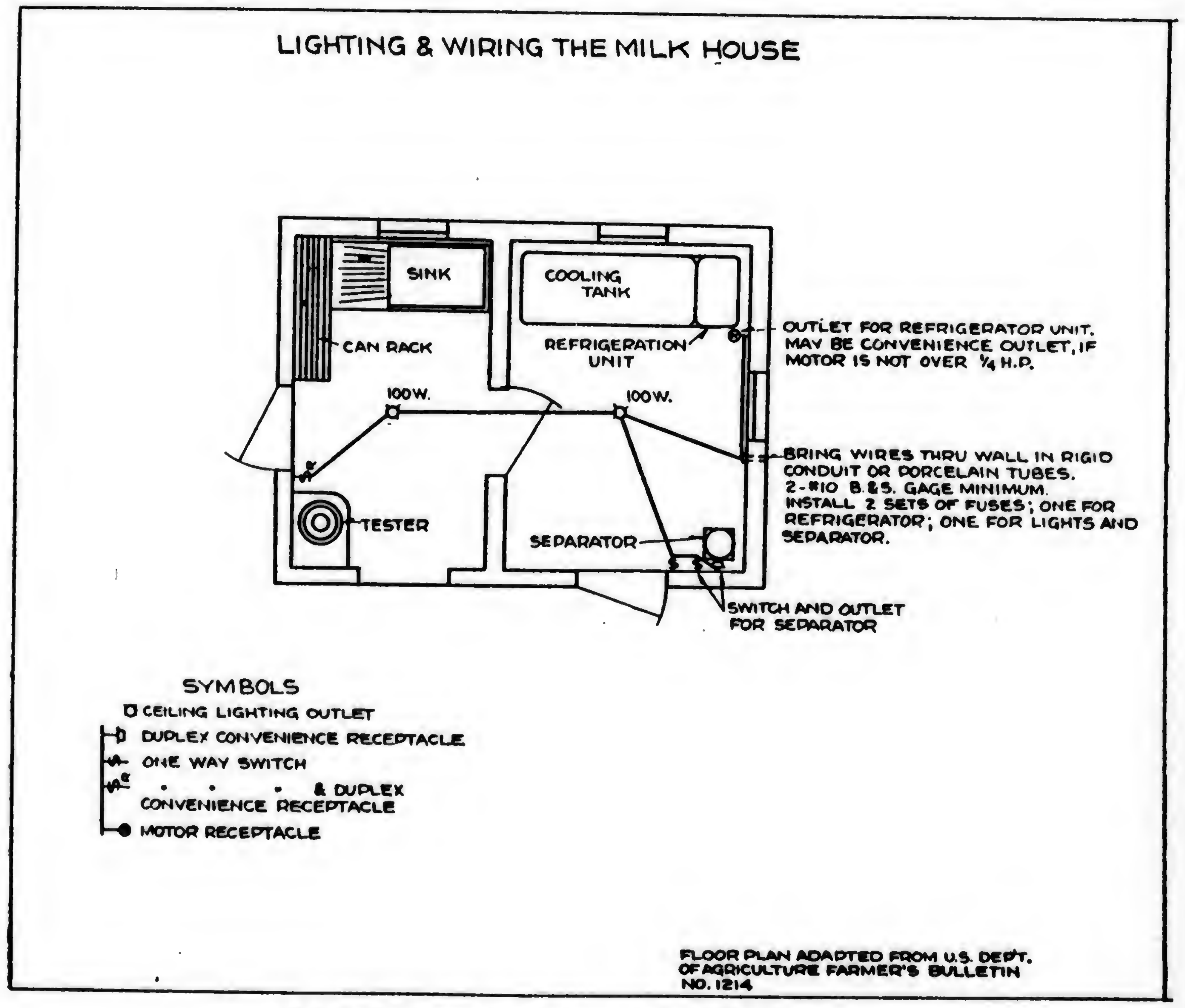

WIRING THE FARMSTEAD
WIRES BETWEEN BUILDINGS
DWELLING TO PUMP HOUSE:
3-NO. 6 TO BARN
3-NO. 8 TO GARAGE LIGHT
PUMP HOUSE TO BARN:
3-NO. 6 FOR MOTORS AND LIGHTS
3-NO. 8 FOR BARN DOOR LIGHT (FUSE IN BARN)
BARN TO SHOP
3-NO. 8 FOR LIGHTS AND MOTORS
2-NO. 8 FOR WATER TROUGH LIGHT
POLE "A" TO DWELLING:
3-NO. 6 SERVICE WIRES FROM TRANSFORMER
3-NO. 8 FOR YARD LIGHTS
OTHER RUNS AS INDICATED. ALL SIZES ARE B.&S. GAGE WEATHERPROOF COPPER WIRE.
NOTE:
NO. 8 B.&S. GAGE IS MINIMUM RECOMMENDED FOR OUTDOOR WORK, BECAUSE OF MECHANICAL STRENGTH REQUIREMENTS.
METER IS LOCATED IN BASEMENT OF DWELLING.
THREE WAY SWITCHES ON LIGHTS:
FOR YARD LIGHTS:
ONE AT DWELLING, ONE ON POLE AT ENTRANCE
FOR GARAGE:
ONE AT DWELLING, ONE AT GARAGE
FOR BARN DOOR LIGHT:
ONE AT PUMP HOUSE, ONE AT BARN
LOT PLAN ADAPTED FROM U.S. DEPT. OF AGRICULTURE FARMER'S BULLETIN NO. 1132
WINDBREAK
ORCHARD
ROOT CROP
GARAGE
DWELLING
GARDEN
CORN CRIB
HORSE & DAIRY BARN
HOGS
PUMP HOUSE
WATER TROUGH
FEED RACK
SWITCH AT BARN
CUSTOMER'S POLE "A"
SCALE IN FEET
PUBLIC HIGHWAY
LIGHTING COMPANY POLE
LIGHTING COMPANY TRANSFORMER ON THIS POLE
LIGHTING COMPANY HIGH VOLTAGE LINE
LIGHTING COMPANY POLE

Typical Wiring Layout for the Farmstead.

Yard Lighting: Where the lighting unit can be suspended from a bracket arm mounted on a convenient pole or on the corner of a house or barn, the RLM reflector (the Reflector and Lamp Manufacturer's standard) with 100-watt or 150-watt lamp is recommended. In some locations angle reflectors can be used effectively to flood light an area from the side of a building. For best results all yard lights should be mounted at least 15 feet or higher.

The system may be connected so that a single switch in the house will turn on all the yard lights. In truck gardens, orchards, vineyards, poultry houses, etc., it is sometimes desirable to install a few lights connected to this same circuit as a protection against thieves.

Dairy Barn: A recommended installation for the dairy barn consists of a row of RLM reflectors over each feeding and cleaning alley, with 100-watt inside-frosted lamps. The distance between reflectors should equal 1½ to 2 times their height above the floor. The reflec-


LIGHTING & WIRING THE MILK HOUSE
SINK
COOLING TANK
CAN RACK
REFRIGERATION UNIT
100W.
100W.
TESTER
SEPARATOR
OUTLET FOR REFRIGERATOR UNIT. MAY BE CONVENIENCE OUTLET, IF MOTOR IS NOT OVER ¼ H.P.
BRING WIRES THRU WALL IN RIGID CONDUIT OR PORCELAIN TUBES. 2-#10 B.&S. GAGE MINIMUM. INSTALL 2 SETS OF FUSES; ONE FOR REFRIGERATOR; ONE FOR LIGHTS AND SEPARATOR.
SWITCH AND OUTLET FOR SEPARATOR
SYMBOLS
CEILING LIGHTING OUTLET
DUPLEX CONVENIENCE RECEPTACLE
ONE WAY SWITCH
" " " & DUPLEX CONVENIENCE RECEPTACLE
MOTOR RECEPTACLE
FLOOR PLAN ADAPTED FROM U.S. DEPT. OF AGRICULTURE FARMER'S BULLETIN NO. 1214

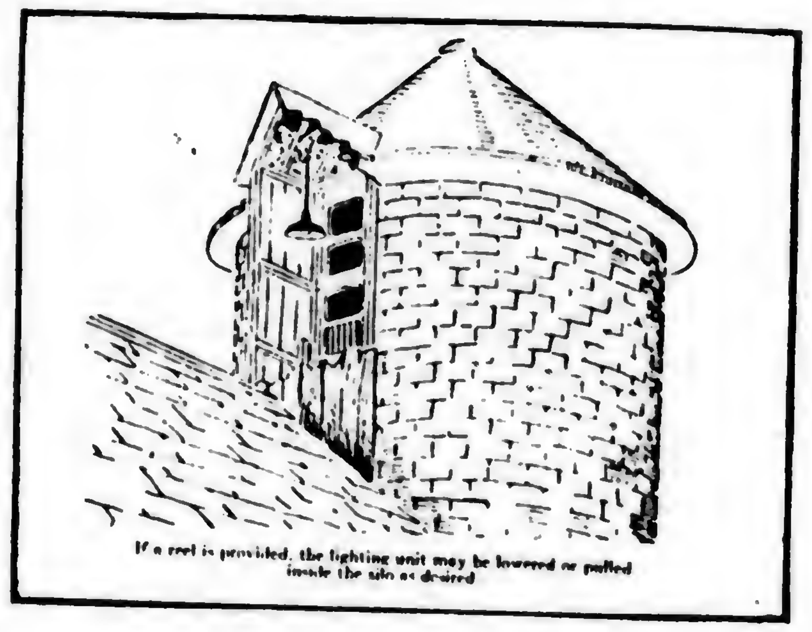
Lighting and Wiring the Milk House.

tors should be mounted as close to the ceiling as is practicable and those over cleaning alleys should be staggered with those over the feeding alleys.

Milk House: The small cooling and separator house with low ceiling requires but a single 100-watt inside-frosted lamp mounted at the center of the ceiling. Where they are only rafters above, a reflector should in every case be added. Even with a smooth light-colored ceiling a reflector improved the illumination.

In the bottling room of the retail dairy, ample light is needed so that the work may be done efficiently and thoroughly. Cleanliness here is essential, and this is furthered by more light. Good results are obtained with RLM reflectors and 100-watt inside-frosted lamps, mounted close to the ceiling and spaced about 10 feet apart each way.

Silo and Chute: A 60-watt or 100-watt inside frosted lamp should be mounted in an RLM or angle reflector near the top of the silo, over the chute or space between silo and barn, and so located that it will direct some light within the silo through the open doors.



If a reel is provided, the lighting unit may be lowered or pulled inside the silo as desired

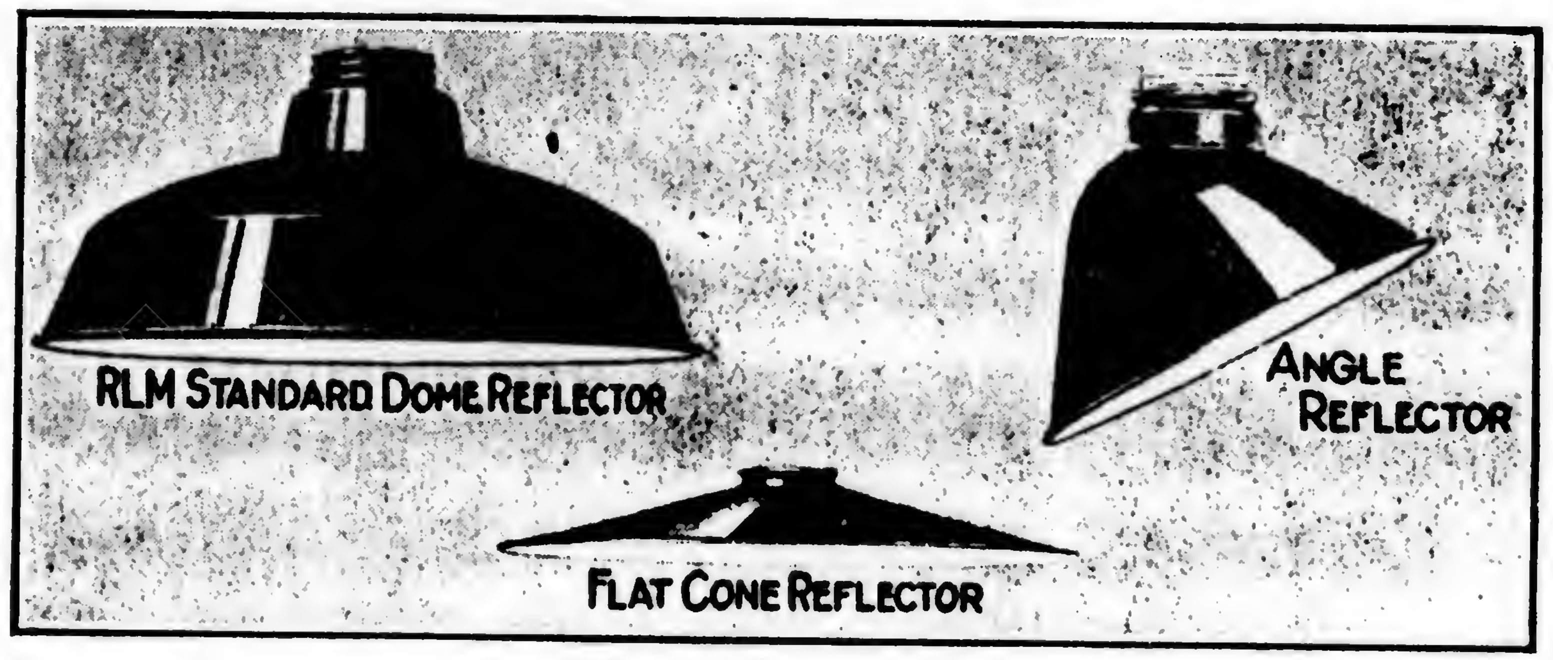
Silo Lighting.

If the lighting unit is mounted on a reel, so that it may be pulled down, it is a simple matter to lower it inside the silo when light is needed. In this case the wire should have the tough rubber outer insulation now in general use for portable service, to minimize fraying and possibility of short circuit.

Another method consists of placing lamps in angle reflectors in the chute, spacing them about ten feet apart vertically opposite doors. The reflectors are turned to throw the light into the interior of the silo.

Barn Lighting: A suggestion for the lighting of typical high-roofed barns and hay mows, where the chief requisite is the ability to move about in safety and comfort, is the use of 100-watt inside-frosted lamps in angle reflectors or dome reflectors set at an angle, mounted fairly high on central posts or tiebeams, or over the door, and directing the light into the bays.

Where stalls are located on both sides of a central aisle, sufficient light is obtained from 60-watt or 100-watt inside frosted lamps in reflectors mounted along the center of the passageway and as near the ceiling as is practicable. With this high mounting the maximum amount of light is directed to either side. One reflector should be mounted on the partition line between every other pair of opposite stalls; with this arrangement each unit provides light for four stalls.

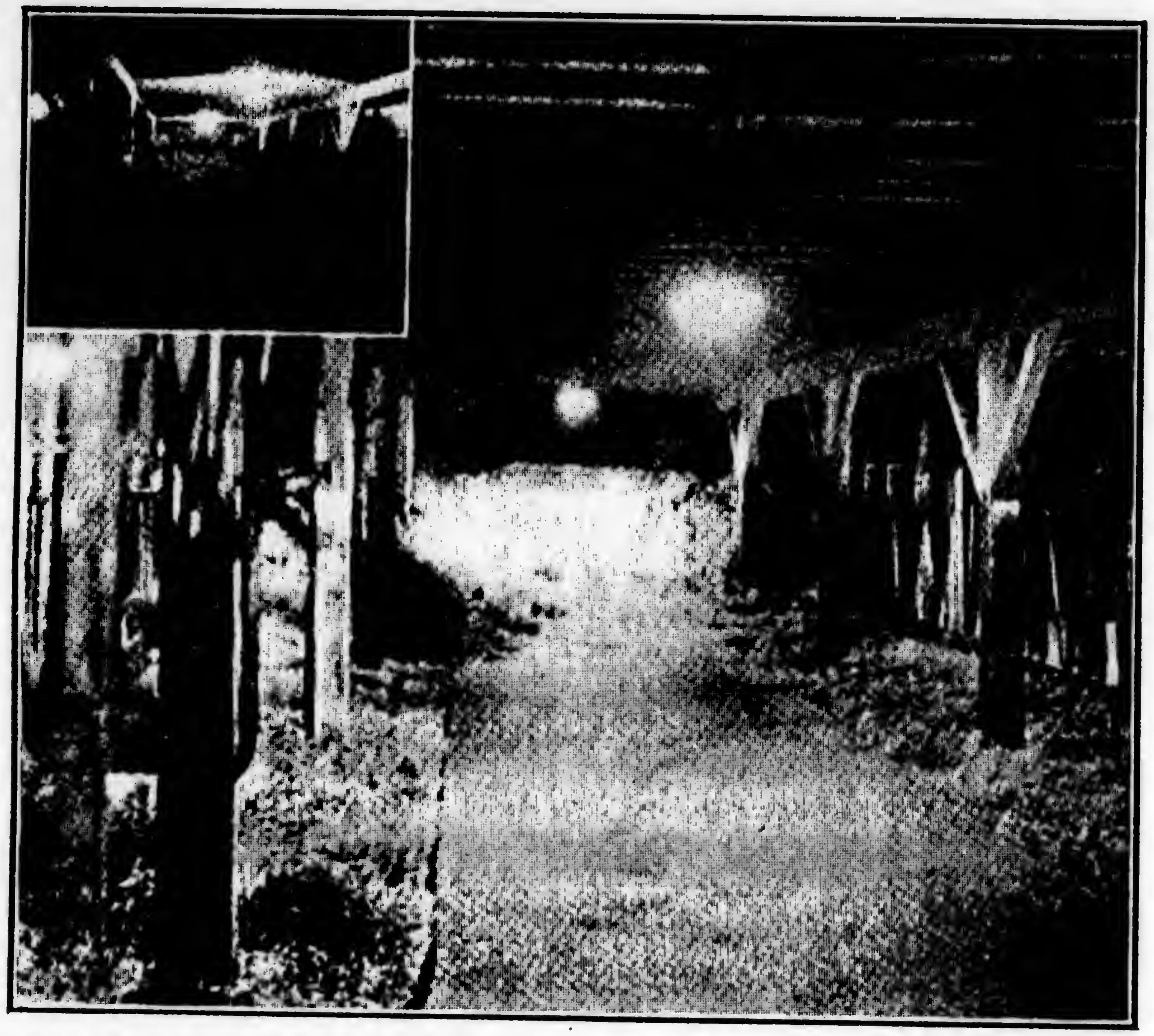


Typical Steel Reflectors

It is suggested that a 25-watt inside-frosted lamp be mounted, out of reach of the horses head, on the wall or on a joist between each two stalls. These lamps should be on individual switches, to be used only when needed. They will be found to be very handy when working in the stalls.

For a box stall, a 50-watt lamp in an RLM or a shallow reflector, mounted close to the ceiling in the center, is ordinarily sufficient. The switch should preferably be located outside the stall door.

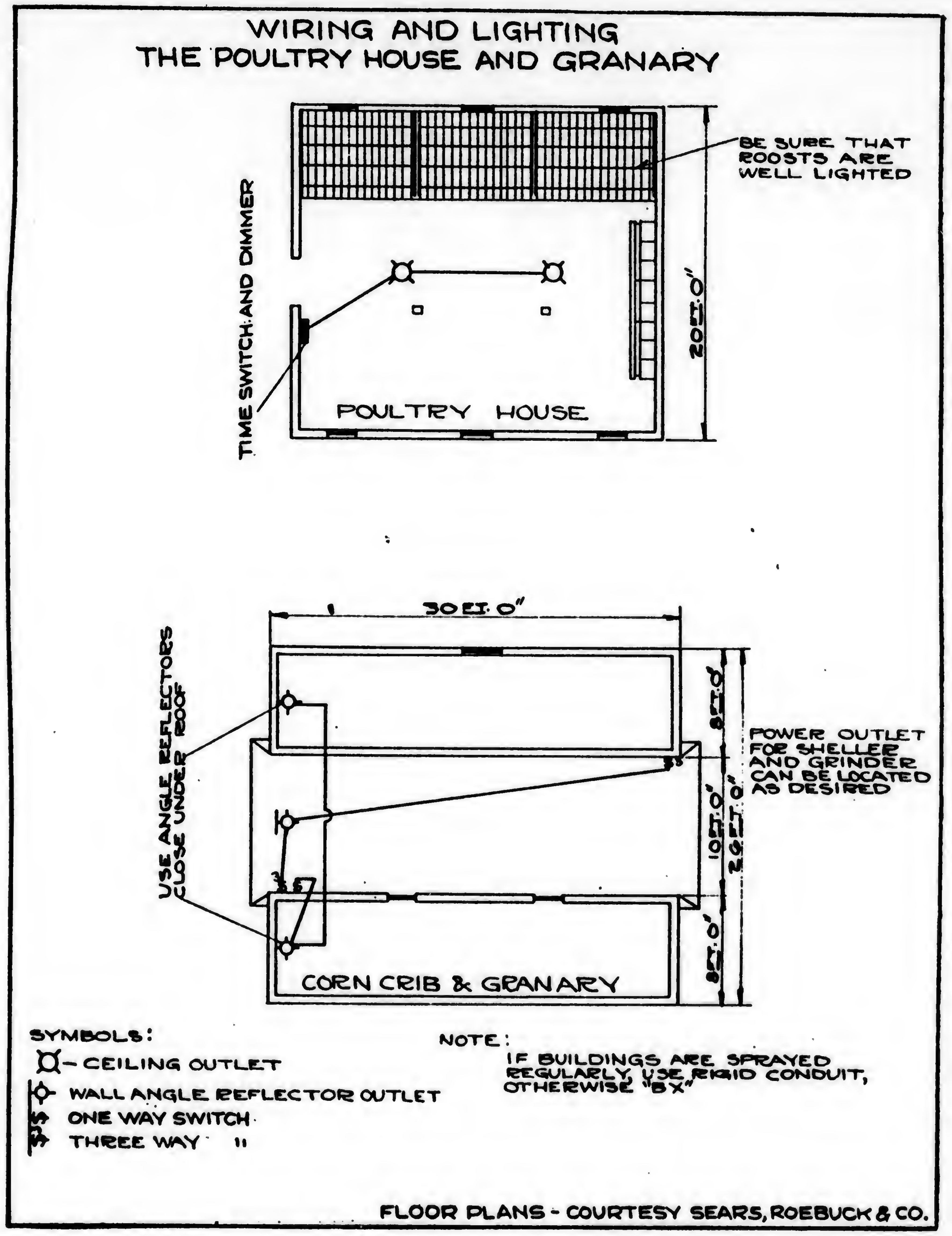
A 25-watt lamp mounted on the wall high above the floor provides sufficient light for the small grain room. The switch should be in a convenient place, such as just outside the door.



The insert shows that without reflectors, the lighting is uneven and dimly lighted barn results.

Poultry House: For egg production the general illumination of the poultry house is as important as the illumination on the floor. If the perches are dark the birds will not come down to feed, and if only a small area of the floor is lighted they will crowd together within the lighted space. Hence reflectors that have a widespread distribution of light should be used. RLM reflectors are recommended, with flat porcelain-enameled steel units as second choice. The use of reflectors reduces materially the lamp wattage required.

One 50-watt inside-frosted lamp in an RLM Dome or flat reflector



WIRING AND LIGHTING
THE POULTRY HOUSE AND GRANARY

BE SURE THAT ROOSTS ARE WELL LIGHTED
TIME SWITCH AND DIMMER
20 FT. 0"
POULTRY HOUSE
30 FT. 0"
USE ANGLE REFLECTORS CLOSE UNDER ROOF
8 FT. 0"
10 FT. 0"
26 FT. 0"
8 FT. 0"
POWER OUTLET FOR SHELLER AND GRINDER CAN BE LOCATED AS DESIRED
CORN CRIB & GRANARY
SYMBOLS:
– CEILING OUTLET
WALL ANGLE REFLECTOR OUTLET
ONE WAY SWITCH
THREE WAY "
NOTE:
IF BUILDINGS ARE SPRAYED REGULARLY, USE RIGID CONDUIT, OTHERWISE "BX"

FLOOR PLANS - COURTESY SEARS, ROEBUCK & CO.

For a box stall, a 50-watt lamp in an RLM or a shallow reflector, mounted close to the ceiling in the center, is ordinarily sufficient. The switch should preferably be located outside the stall door.

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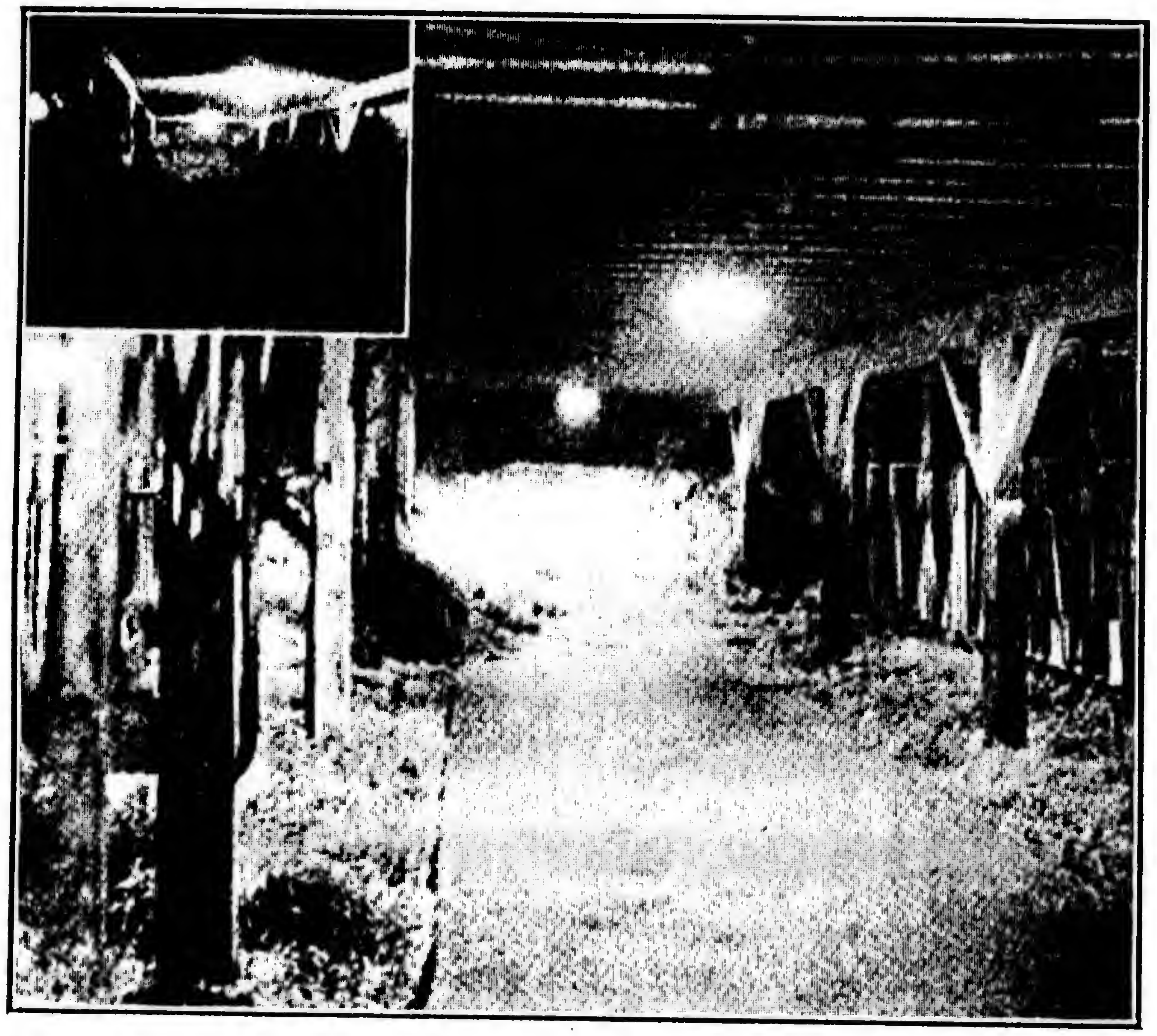

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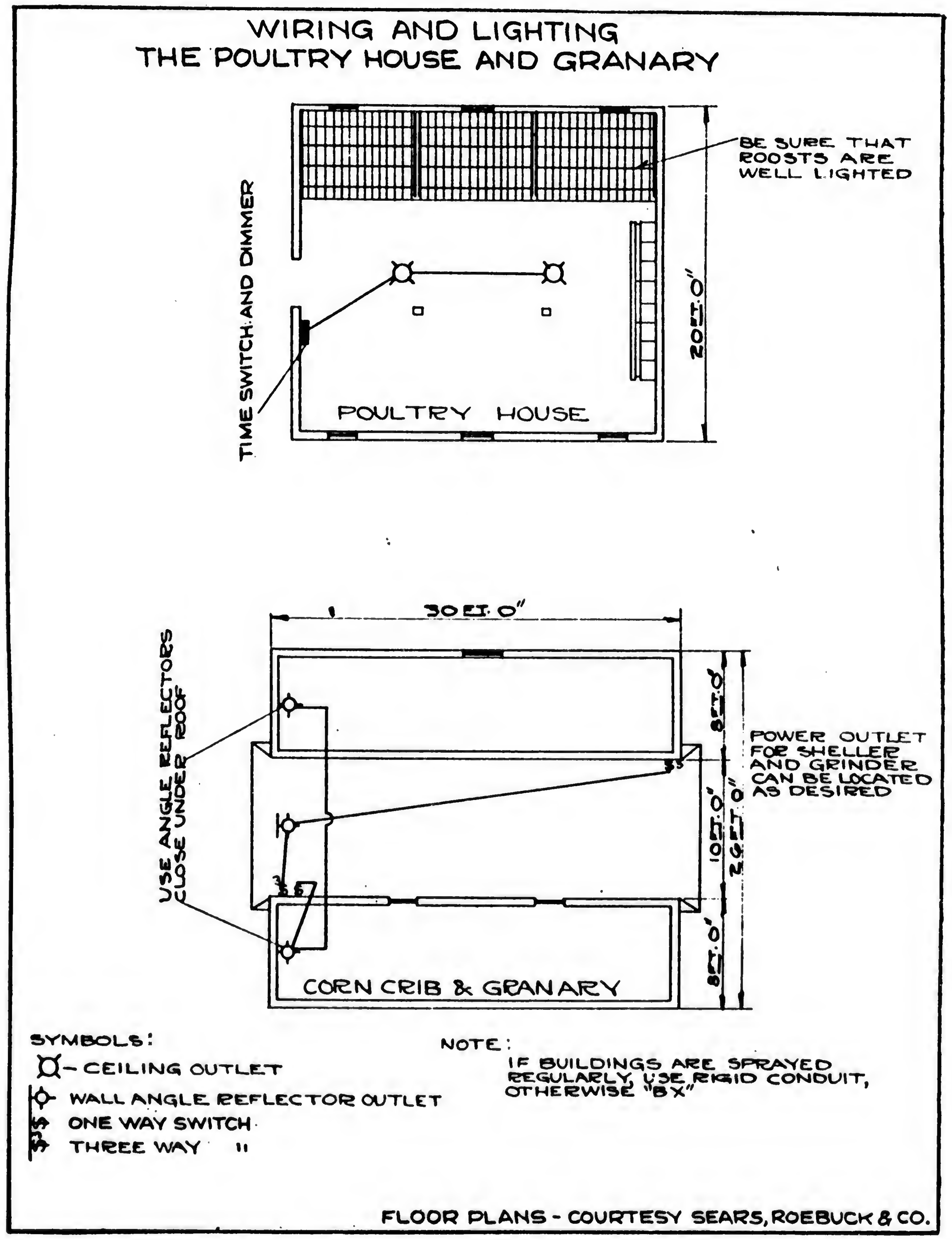

WIRING AND LIGHTING
THE POULTRY HOUSE AND GRANARY

BE SURE THAT ROOSTS ARE WELL LIGHTED
TIME SWITCH AND DIMMER
20 FT. 0"
POULTRY HOUSE
30 FT. 0"
USE ANGLE REFLECTORS CLOSE UNDER ROOF
8 FT. 0"
10 FT. 0"
26 FT. 0"
8 FT. 0"
POWER OUTLET FOR SHELLER AND GRINDER CAN BE LOCATED AS DESIRED
3S
CORN CRIB & GRANARY
SYMBOLS:
- CEILING OUTLET
WALL ANGLE REFLECTOR OUTLET
ONE WAY SWITCH
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NOTE:
IF BUILDINGS ARE SPRAYED REGULARLY, USE RIGID CONDUIT, OTHERWISE "BX"

FLOOR PLANS - COURTESY SEARS, ROEBUCK & CO.

INTENTIONAL 2ND EXPOSURE

mounted near the ceiling on a line midway between the front of the house and the front of the dropping boards should be provided for about every 200 square feet of floor area.

Farm Shop: Ample lighting in the farm shop makes repair work at night possible and convenient; it becomes unnecessary for the farmer to break into his day for the many minor repairs. To facilitate work there should be freedom from heavy shadows. This is obtained by the use of more than one light source. Excellent results will be obtained from RLM reflectors with 100-watt inside frosted lamps mounted 10 feet above the floor and spaced about 10 feet apart each way. One of those units should be hung directly over the bench, or two if the bench is long. An extension cord with wire guard to protect the lamp, will be found useful for working about machinery.

SOME ITEMS TO SPECIFY IN LETTING A WIRING CONTRACT

The electrical specifications covering the wiring contract should provide for the following important items and should be in writing.

1. That all wiring should be installed in accordance with the provisions of the latest edition of the National Electrical Code of the National Board of Fire Underwriters.
2. That both the rough wiring and the fixture wiring be inspected by the Underwriters Association having jurisdiction. Application for such inspection should be made by the contractor who will secure a certificate of approval from the inspecting body. This to be given to the owner.
3. That the main switch, entrance wires, and entrance conduit should be of specified size and capacity.
4. That the distribution panel make provision for the barn feeder, the range circuit and the house panel board and that the switches and fuses of this distribution panel be of a specified size.
5. That the house panel board contain a specific number of circuits for the house and that the feeder to the panel board from the main switch be of specified size.
6. The number and size of wires to be run to the barn and other outbuildings.
7. The branch circuit wire sizes for interior work; usually No. 12 B. & S. gage minimum and for exterior work (not in rigid conduit) No. 8 B. & S. gage minimum.
8. The location and size of each motor or other power outlet.
9. A schedule of ceiling and wall lighting outlets, switch and convenience outlets for all buildings to be wired. If complete wiring plans accompany the specifications, the above schedule may be omitted.
10. The wiring method—whether Knob and Tube, BX Cable, Rigid Conduit, Non-Metallic Sheathed Cable, or combinations of the above.

11. All wire used indoors to be rubber covered; all wire used outdoors to be weatherproof insulation unless installed in rigid conduit.
12. Rigid conduit used in dry locations indoors is to be black enameled. If used in a damp location or outdoors it is to be galvanized or sherardized.

SAFETY DOES NOT MEAN ADEQUACY

Electricity, when provided for with proper wiring, switches, fuses and other safety appliances is one of the safest and most fool-proof servants at the farmer's disposal. It is only when abused that it loses this characteristic. As a standard of installation from a safety standpoint, the industry has prepared the *National Electrical Code of the National Board of Fire Underwriters.* This set of rules, based on safety standards and not on standards of good lighting practice, which are much higher, specifies the various methods of wiring which may in general be employed and is a rule for the installation of wiring and equipment.

To assure the user of the safety of his installation, the Fire Underwriters maintain inspection bureaus. The inspector's approval, which should be obtained on every electrical installation, and which most electric lighting companies require before furnishing service, stamps the wiring system as having passed the minimum requirements consistent with safety as specified by the *National Electrical Code.* It also means that the materials used have been approved by the Laboratories, maintained by the National Board of Fire Underwriters, since the inspecting bodies recognize only such materials. Application for inspection is made by the electrical contractor who then receives from the inspecting body a certificate of approval which becomes the property of the farmer having the work done.

All wiring should be installed in accordance with the provisions of the latest edition of the *National Electrical Code.* Present Code is dated 1925; next edition probably will be released in 1929.

It should be borne in mind that the inspector's approval does not mean that the system is complete and adequate to light the buildings and to provide for the many labor and time saving devices developed for farm use. Nor does this approval mean that it will be an economical system from an operating standpoint. In most cases, standards higher than the Code are necessary.

To prevent disappointment and dissatisfaction, some suggestions regarding proper wiring from the use standpoint are made in the foregoing paragraphs. They are minimum operating standards, based on experience, and are in accordance with the *National Electrical Code.* It will save future needless inconvenience and additional expense if contracts for farm electrical work include the appropriate requirements as given.

ALLOWABLE CURRENT-CARRYING CAPACITIES OF COPPER WIRE*

Table showing allowable current—carrying capacities of various sizes of copper wire used in farm wiring:—

Size of Wire in B & S Gage	Current-Carrying Capacity in Amperes Rubber Covered Wire	 Weather-Proof Wire
14	15	
12	20	
10	25	
8	35	50
6	50	70
4	70	90
3	80	100
2	90	125
1	100	150
0	125	200
00	150	225
000	175	275
0000	225	325

WIRING DATA FOR SINGLE-PHASE MOTORS†

Motor Rating in Horse Power	Average Full lead in Amperes	Circuit Wire Size, B & S Gage "Rubber covered"	Fuses for Running Protection in Ampere	Safety Switch Size if Separate Circuit is installed	Remarks
		110 Volt Motors			
1/6**	3.34	14	10	30	
¼**	4.8	14	10	30	
½	7.0	12	10	30	
		220 Volt Motors			
½	3.75	14	5	30	Motors ½ H. P. and larger preferably should be protected by motor starting switches equipped with inverse time protective cutouts or over load relays
¾	4.7	14	8	30	
1	5.5	14	10	30	
1-½	7.6	12	15	30	
2	10.0	10	20	30	
3	14.0	8	25	30	
5	23.0	6	40	60	

*From 1925 Edition National Electrical Code.

†Data for this table taken from: "Wiring Data for Motors." Trumbull Electric Mfg. Co.

**Can be connected to convenience outlet, if balance of load on circuit is not too heavy.

The wire and fuse sizes given above are recommended for general practice.

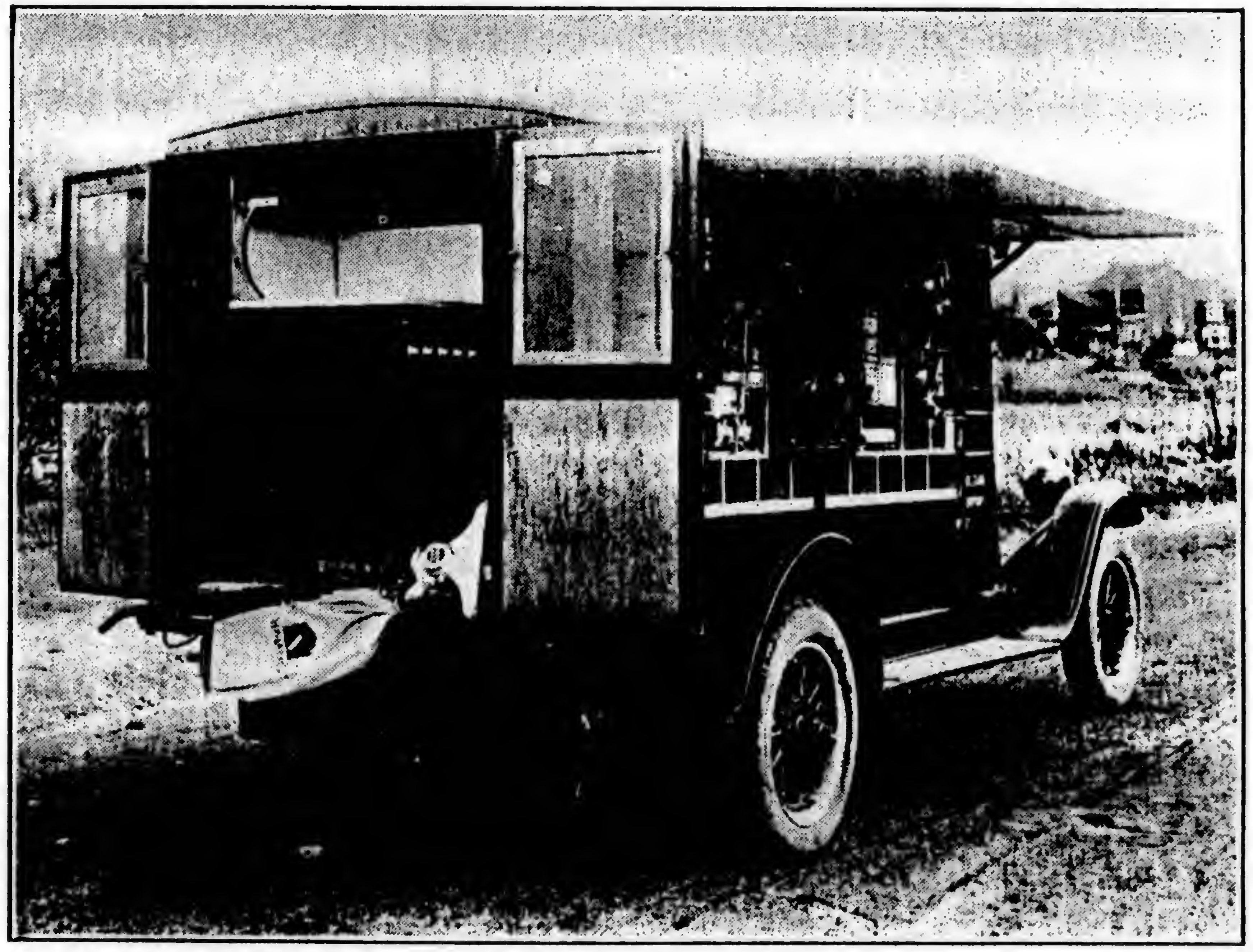
PART IV

AIDS AVAILABLE TO THE PENNSYLVANIA FARMER FOR RURAL ELECTRIFICATION

When electric service becomes available the rural consumer is faced by many new problems as to the wiring system to be installed, the many applications of electricity that can be made, the results that may be expected and the appliances best suited to the work to be done. The following sources of assistance or information are suggested as an aid in solving the problems that will be met.

The Electric Company

Electric companies have, as a part of their work—furnishing electric service, found it necessary to render certain services in order to bring about the most efficient use of their product. They have, therefore, a force of skilled employes qualified by training and experience to assist the customers in the laying out of a wiring system and determining the materials to be used, to advise as to the size of motors



Rural Electric Service Demonstration Truck

ALLOWABLE CURRENT-CARRYING CAPACITIES OF COPPER WIRE*

Table showing allowable current—carrying capacities of various sizes of copper wire used in farm wiring:—

Size of Wire in B & S Gage	Current-Carrying Capacity in Amperes Rubber Covered Wire	Weather-Proof Wire
14	15	
12	20	
10	25	
8	35	50
6	50	70
4	70	90
3	80	100
2	90	125
1	100	150
0	125	200
00	150	225
000	175	275
0000	225	325

WIRING DATA FOR SINGLE-PHASE MOTORS†

Motor Rating in Horse Power	Average Full lead in Amperes	Circuit Wire Size, B & S Gage "Rubber covered"	Fuses for Running Protection in Ampere	Safety Switch Size if Separate Circuit is installed	Remarks
		110 Volt Motors			
1/6**	3.34	14	10	30	
¼**	4.8	14	10	30	
½	7.0	12	10	30	
		220 Volt Motors			
½	3.75	14	5	30	Motors ½ H. P. and larger preferably should be protected by motor starting switches equipped with inverse time protective cutouts or over load relays
¾	4.7	14	8	30	
1	5.5	14	10	30	
1-½	7.6	12	15	30	
2	10.0	10	20	30	
3	14.0	8	25	30	
5	23.0	6	40	60	

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*From 1925 Edition National Electrical Code.

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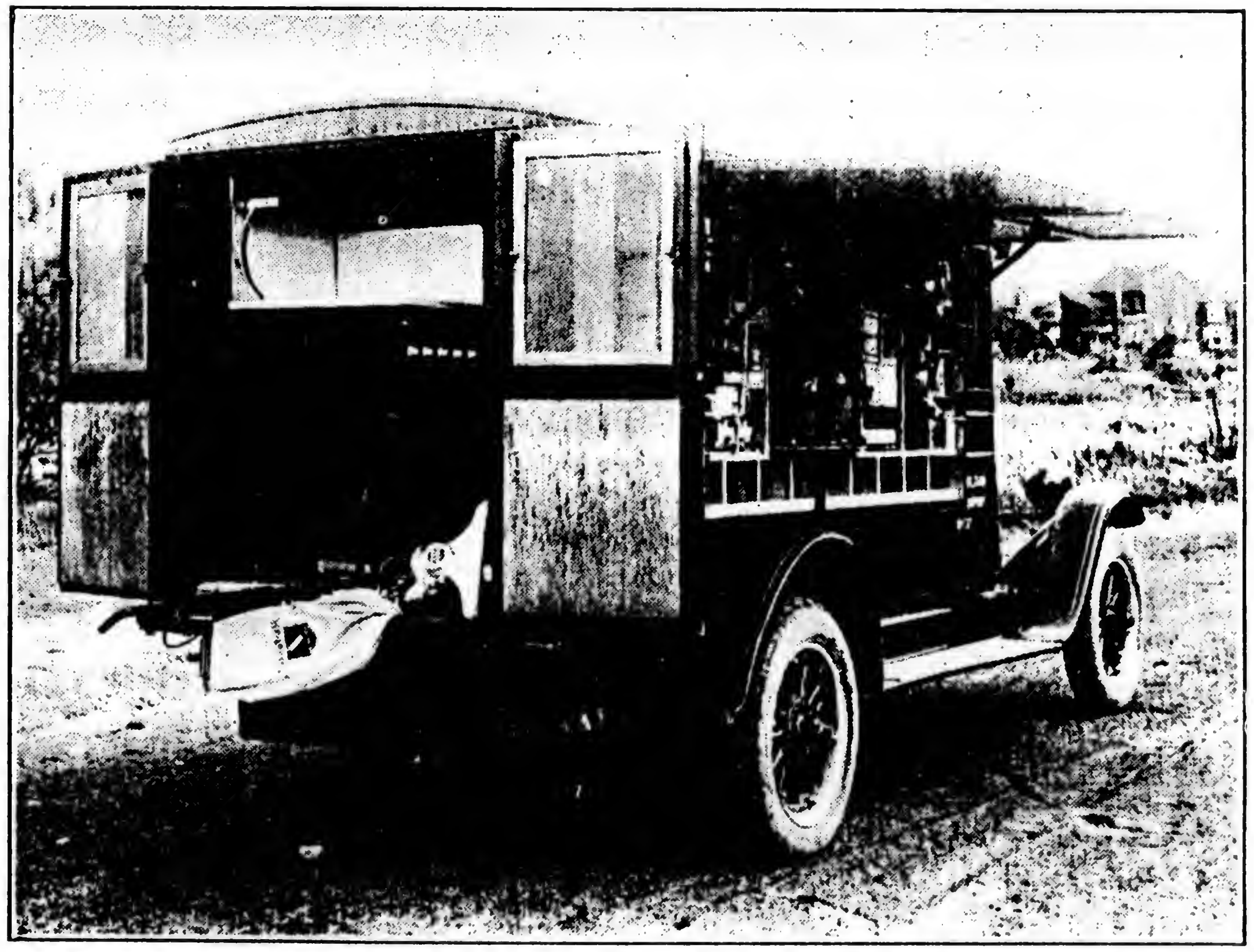

Rural Electric Service Demonstration Truck

INTENTIONAL 2ND EXPOSURE

necessary for different operations and to render assistance in the adaptation of farm equipment to these motors and finally to demonstrate the use of appliances.

Some of the larger electric companies have provided Rural Electric Service Demonstration Trucks that are fully equipped with the latest household and farm appliances so arranged that the electric company representatives can give actual demonstrations of the equipment in operation.

Those who take advantage of this information, which is provided by the electric companies as a part of their service, will safeguard themselves against costly mistakes and unnecessary expenditures and assure themselves better service.

The Pennsylvania State College

As the State educational institution entrusted with the duty of carrying out the State and Federal Government's program of research, teaching and extension in the field of agriculture and mechanic arts, the Pennsylvania State College is in a position to render service in connection with the problems of rural electrification. The electric companies have offered to cooperate to the fullest extent with the College by making the service of their engineers available and in providing and operating any equipment needed for research projects or demonstrations. The Agricultural Extension representative, whose office is at the County Seat, can be of assistance to any community in arranging for educational demonstrations and meetings.

SOURCES OF PUBLISHED INFORMATION

Electricity—The Pathway of Prosperity—Westinghouse Electric & Mfg. Co., Pittsburgh.

The New Farm Help—Westinghouse Electric & Mfg. Co., Pittsburgh.

Handy Wiring Tables—Westinghouse Electric & Mfg. Co., Pittsburgh.

Your Man Friday—Every Day in the Week—Graybar Eectric Company New York.

Making It Easy to Grind—Wagner Electric Corporation, St. Louis, Missouri.

Lighting the Home—Westinghouse Lamp Company, New York.

Residence Lighting—Westinghouse Lamp Company, New York.

Electric Light on the Farm—Edison Lamp Works, Harrison, N. J.

Farm Lighting—National Lamp Works, Cleveland, Ohio.

The G. E. Farm Book—General Electric Company, Schenectady, New York.

Wiring Systems—General Electric Company, Bridgeport, Conn.

Portable Farm Motors—General Electric Company, Schenectady, New York.

Electricity on the Farm—Farm Light & Power Company, New York.

Electricity on New England Farms—Bul. No. 228 New Hampshire Agricultural Experiment Station, Durham, New Hampshire.

Turn on the Light—Cir. No 163 University of Wisconsin, Madison, Wis.

The Use of Electricity on Farms—Bul. No. 10 Michigan Engr. Expr. Station, East Lansing, Mich.

Manure and Electric Hotbeds—Bul. No. 219 State College of Washington, Pullman, Washington.

Electricity for Indiana Farms—Cir. No. 127 Purdue University, Lafayette, Ind.

Turn on the Switch—Cir. No. 134 Purdue University, Lafayette, Ind.

Present Status of Rural Electrification in Kansas—Bul. No. 16 Kansas Agr. College, Manhattan, Kans.

Dairy Cold Rooms with Electric Refrigeration—New Hampshire Agr. Exp. Station, Durham, New Hampshire.

Silo Filling with a 5 H. P. Motor—New York State College, Ithaca, N. Y.

Stationary Spray Plants in California—Bul. No. 405 University of California, Berkeley, Cal.

Progress Report of Light Traps for Insect Control—Empire State Gas & Electric Asso., Grand Central Terminal, N. Y.

Artificial Illumination of Poultry Houses for Winter Egg Production—New York State College, Ithaca, N. Y.

Electric Water Heater for Poultry—Cir. No. 81 Oregon Agr. College, Corvallis, Oregon.

Electric Brooding—Bul. No. 441 University of California, Berkeley, Cal.

The National Committee on the Relation of Electricity to Agriculture 58 East Washington Street, Chicago, Ill., is in touch with developments throughout the United States, and issues valuable publications.

End of Title